SCIENTIFIC AMERICAN

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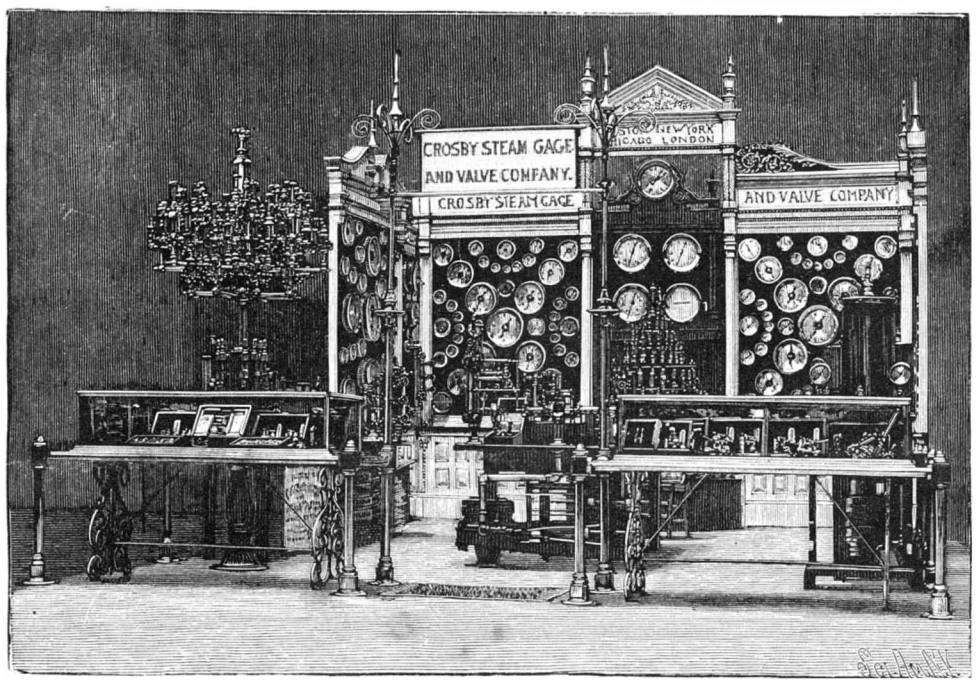
CROSBY STEAM GAUGE AND VALVE CO.'S EXHIBIT.

Beauty of design, excellence of workmanship, and tasteful arrangement are the striking characteristics of the exhibit of the Crosby Steam Gauge and Valve Company at the World's Columbian Exposition.

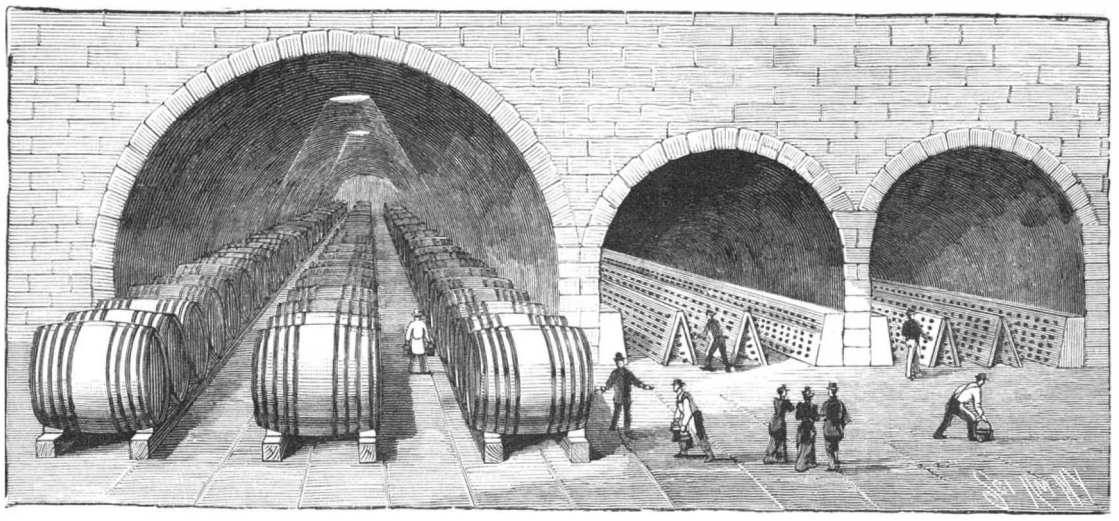
These qualities are evident to the most casual observer and appeal with especial force to the engineer or skilled mechanic, and have from the commencement of the Fair attracted a large and well-deserved share of attention from visitors.

The exhibit contains many important specialties in the line of steam appliances, for which superior merits are claimed, among which may be mentioned the Crosby improved steam gauge, the Crosby pop safety valve and water relief valve, the Meady muffled pop safety valve, the Crosby steam engine indicator, the single bell chime whistle, Bosworth's pump governor and feedwater regulator, Johnstone's blow-off valve, patent gauge tester, safe water gauge, etc.

The hollow double spring in the Crosby improved steam gauge is so shaped and arranged, and the mechanism such, that the vertical as well as the horizontal movement of its free ends is fully utilized; by which ample movement of the pointer is obtained with only half the movement ordinarily required of the spring; consequently a spring 100 per cent stronger than usual can be employed. This constitutes the special feature of the Crosby improved steam gauge and is a very important one, as the use of a stiff spring insures steadiness of the pointer; and as only a small movement of the spring is required, a tendency to "set" from getting overheated is practically eliminated. This point of superiority is what has given the Crosby gauge the high reputation which it has held since its introduction, nearly twenty years ago.



THE CROSBY STEAM GAUGE AND VALVE CO. EXHIBIT.



UNDERGROUND VAULTS OF THE LAKE KEUKA WINE CO.

The Crosby pop safety valve for locomotive, stationary, marine, portable, and farm engine boilers is a perfect protection from excess of steam pressure. These valves, which are automatic in action, can be relied upon to open at the right time, give ample relief, and close with but slight loss of pressure.

The Crosby water relief valve is for the purpose of relieving all overpressure of water in steam pumps, fire engines, hydrants, hose, and wherever an automatic valve is needed to relieve overpressure of water and prevent damage, which, in the absence of such safety device, would be sure to occur.

The Crosby steam engine indicator is designed to meet the requirements of modern steam engineering practice. The high-speed system of construction in steam engines which greatly prevails to-day renders the old type of indicator well nigh useless. Many details which gave little trouble at low speeds cause errors under the present requirements which seriously affect the results. Every part is perfectly adapted to its particular function, and also to its relation to all the other parts, in size, proportion, and material, and finer results can be obtained with it than with any other instrument. Its superior qualities were duly recognized at the Paris Exposition in 1889, where it received the highest award, a gold medal, and the identical instrument which received that honor is a part of this exhibit.

The Bosworth feedwater regulator is an apparatus for maintaining an even water line in a steam boiler. This it does with greater precision and certainty than is possible for any fireman or attendant to do. The valves are controlled automatically by

EXHIBIT OF THE LAKE KEUKA WINE CO.

SAFETY STEAM APPLIANCES, ETC.—J. E. LONERGAN & CO., OF PHILADELPHIA.

THE WORLD'S COLUMBIAN EXHIBITION—ENGINEERING SPECIALTIES—THE LAKE KEUKA WINE CO.

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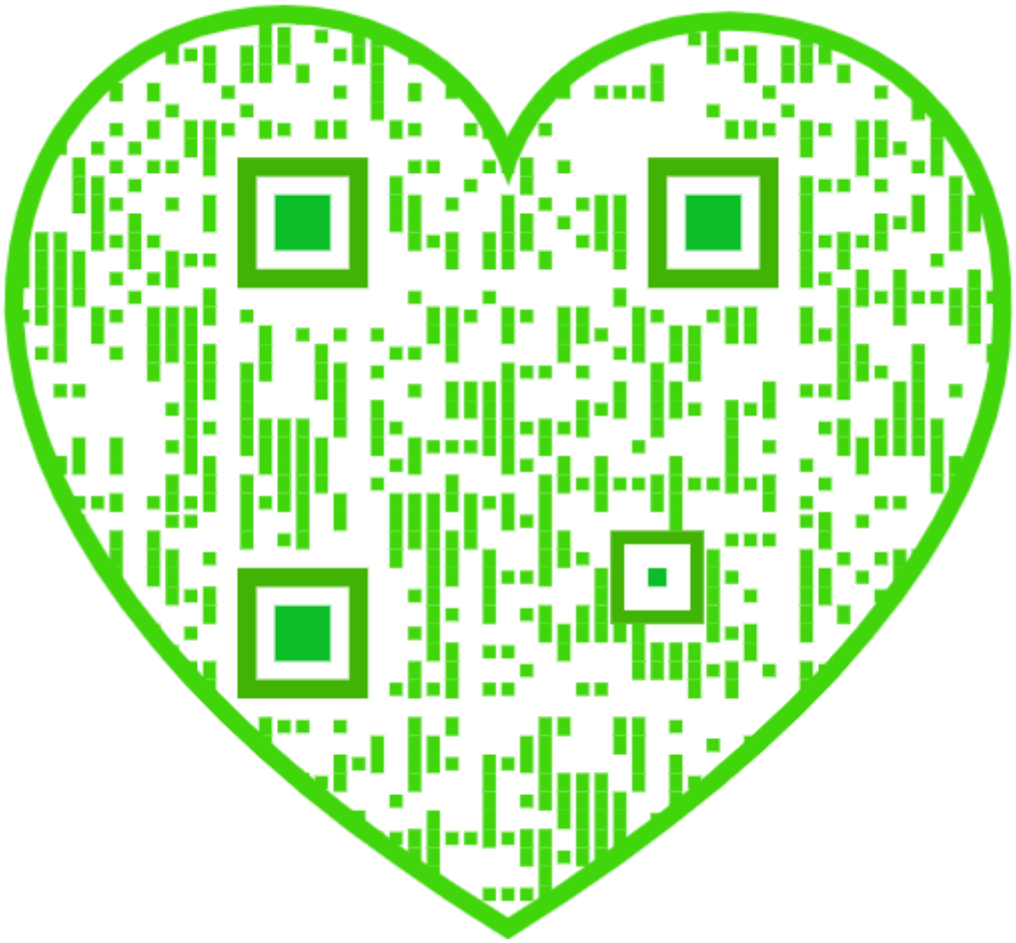

positive forces, acting independently of each other, and adjustable within wide ranges of power.

The Johnstone blow-off valve can be moved entirely from its seat, so that there is a straight way opening through the valve body. The sliding of the valve under pressure maintains its surfaces and its seat in close contact, and if any scale or other foreign matter intervenes, tending to impair such contact, it is destroyed or displaced by attrition of parts when so operated.

The patent gauge tester is a very simple and accurate machine for testing gauges of all kinds, from the lowest to the highest pressure. These machines are made and tested with extreme care and nicety, and are preferable to a mercury column in every point of comparison. They are a necessity in all establishments where many pressure gauges are used.

The original single bell chime whistle is manufactured only by this company. This whistle has three compartments in one cylindrical bell, giving three tones which harmoniously blend into one and produce an agreeable, far-reaching sound.

In this exhibit may be seen also all the various gauges made for special uses, such as hydraulic, for hydraulic presses; vacuum; compound, showing both pressure and vacuum; combination, for waterworks, showing both pressure of water and the height of column; ammonia, for use in refrigerating or ice manufacturing plants; chemical, for use on chemical engines; ordnance, for use on pneumatic gun carriages for measuring the high pressure suddenly produced in the recoil chamber when the gun is discharged; gas governor, to regulate the flow of gas to a vulcanizer or other vessel or boiler; pyrometer, to show both the pressure and temperature of the steam; duplex air brake, for showing both the pressure on the train and in the reservoir; altitude, for showing both the pressure of steam and the height of water in the tank or reservoir in hot water heaters; standard test gauge; engine register or counter, engine room clock, etc.

The exhibit comprises many other articles not specially mentioned, either of a special or staple character, all of which are manufactured or controlled by this company, and in all of which good construction and nice adaptation to their respective uses are apparent to the trained eye and sense.

The main office and works of the company are at Boston, Mass., and the branches in New York, Chicago, and London, England.

LUBRICATORS AND SAFETY STEAM APPLIANCES AT THE FAIR.

The exhibit of J. E. Lonergan & Co., of 211 Race Street, Philadelphia, in Machinery Hall, presents a fine display of self-oilers and steam cylinder lubricators, grease cups and patent safety steam appliances for railroads, machinists, and mill use, etc. The firm are owners and manufacturers of Lynde's patent government regulation pop safety valves for marine, stationary, locomotive, and all steam boilers; also Lonergan's patent adjustable sight-feed oil cup, and Lonergan's cylinder sight-feed attachment. A new automatic crank pin oil cup is shown, which is perfectly adjustable to feed light or heavy oil, and feeds only when crank is in motion, stopping absolutely when crank is not moving. The display with the above named articles also includes a large variety of goods, all of their own manufacture, such as injectors, steam engine governors, gauge and cylinder cocks, steam and vacuum gauges, steam traps, low water alarms, damper regulators, etc. An illustrated descriptive pamphlet of these goods will be sent to applicants.

THE LAKE KEUKA WINE COMPANY EXHIBIT.

Among our first page illustrations is one representing the exhibit of the Lake Keuka Wine Company at the World's Fair, while another picture presents a view in the still wine and champagne vaults of the same company at the place where the wine is made, on Lake Keuka, Steuben County, N. Y. The grapes grown on the shores of this lake have long had the highest reputation for wine-making purposes, in this respect standing on equality with those produced in the most favored localities of France and Germany. To this is to be attributed principally the prosperity and extent of the wine-making industry of Steuben County, a business which has been developing for the past thirty years.

The Lake Keuka Wine Company, with headquarters at Hammondsport, N. Y., at head of the lake, has long had an enviable reputation for their still wines, in barrels, kegs, or bottled, and their special brand of champagne, "Keuka Extra Dry." The absolute purity of their wines can always be depended upon, and their port wines made from black grapes, including the Concord, Clinton, Isabella, Oporto, etc., have a fine, high color, which comes entirely from the grapes themselves, leaving no sediment or deposit in the bottom of the bottle, as is so often found in compounded wines. Their sherries, their St. Julien claret, the dry and sweet Catawbas, and other wines and brandies made by them, all alike have this characteristic purity. Their champagne is made according to the French process of fermentation in the bottle.

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PROTECTION AGAINST TRAIN ROBBERS.

One of our correspondents suggests the use of electricity as an auxiliary to Winchesters and shot guns, for protection of express cars and the locomotive against train robbers. This might prove effectual if the current could be brought under control so as to avoid killing or injuring friends as well as foes. This suggestion seems to be a very good one and is worthy the attention of electrical inventors.

We make a further suggestion of the use of hot water from the locomotive for the protection of the engineer and fireman, of baggage and express men. By means of suitably arranged jets under control of the engineer, fireman, baggageman or expressman, without doubt a very warm welcome could be given to train robbers. No doubt some arrangement of pipes and valves and jets could be devised which could thoroughly protect the engineer and fireman and the several baggage or express cars.

THE BROOKLYN INSTITUTE.

The Brooklyn Institute of Arts and Sciences is a collection of societies composed of people interested in various branches of art and science. Under the able directorship of Prof. Franklin W. Hooper, the institution has risen from a small and struggling handful of persons to an association numbering over 2,700 members. For the annual dues of $5, each member receives tickets to more than four hundred lectures, each ticket admitting two persons to the evening lectures and one to the afternoon. There is something for every taste, and the majority of the lectures have crowded audiences. It is impossible to estimate the educative force of such an institution, which is in fact a university for the people. In addition to the lectures, the institute maintains an art and architectural school, with summer art schools in the Adirondacks and in the Shinnecock Hills of Long Island; a biological laboratory is also maintained in summer at Cold Spring Harbor, Long Island. The Legislature of the State of New York has empowered the city of Brooklyn to expend $300,000 on a museum building near the park. This building will be leased to the Brooklyn Institute at a nominal rent, to house its collections and afford a meeting place.

A SUGGESTED SCHOOL OF FIRE EXTINGUISHMENT.

Mr. Simon Brentano delivered a very able paper on "A School of Fire Extinguishment" at the twenty-first annual meeting of the National Association of Fire Engineers, held at Milwaukee, August 22 to 25, 1893. According to the author, the settlement of this country has been followed by fires of unparalleled magnitude, which may be regarded as a natural consequence of the rapid growth of the country. Proper building laws either do not exist or are disobeyed; furthermore, the rapid accumulation and concentration of values is not usually followed by a corresponding increase in the equipment and *personnel* of the fire department. It is conceded that fire extinguishment is accomplished as much by mental as by brute force. It is a popular belief that every man who is able-bodied is fit to fight fire, but this is erroneous. In our great cities fire extinguishment is taken up in many cases as a last hope, and as a recompense for political support. It is very unfortunate that in most cities the office of chief engineer is looked upon as an important center for partisan purposes and political influence. To the victors belong the spoils, and every change of municipal government sees the removal of the head of the department, and frequently of many of the subordinates. We have in mind a certain Eastern city where the fire chief has been in the position for years, although most of his time is spent in amusement away from the city. Removals from office in the fire department, whether of chief or fireman, should only be made for incompetency, or where there is every reason to believe that the service will be improved. The status of the volunteer fireman is not satisfactory. Too many men are enrolled as members of a volunteer fire company solely to escape local taxation, jury duty, or both; and who avoid active service by the payment of a nominal fine. A State law should be framed defining the position of the volunteer fireman, his qualifications for enrollment, and to provide severe penalties for non-attendance at fires. A law should also be passed providing for an annual State inspection of apparatus, etc.

What we need is a school for fire extinguishment, where systematic training can be given in the science and methods. Such a school would dignify a calling until it reaches the stage of a profession, and would render life and property more secure. The firemen of the United States are, without doubt, the best in the world, but there is still abundant room for improvement.

CRIMINALS are usually of weak physical organization In 1885, 67 per cent of the men in French prisons and 60 per cent of the women were sent to the hospital at some time during incarceration.

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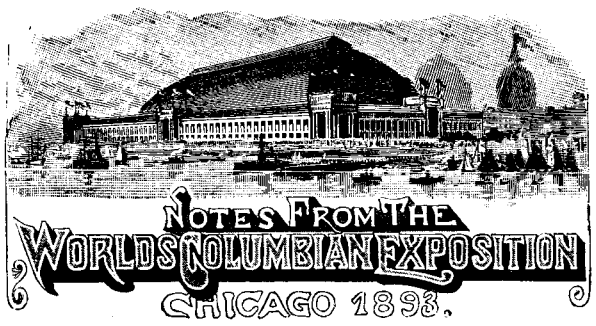

A Day in Machinery Hall.—This building, which with its annex covers twenty acres, gives at once the impression of a busy place. Whirring wheels, clanking drills, swift shuttles, shafting in every possible position, mingle with undistinguishable sounds to make most trying discords. The exhibits are, for the most part, separated only by low railings; this is necessary for good light, but contributes to the sense of hopeless distraction which the visitor at first has. The main structure with its three arched trusses is like a triple railway train house. Traveling cranes, used in the construction of the building, are fitted with platforms and carry visitors from one end to the other, at a height, I should judge, about midway between the floor and roof. From this vantage ground, a comprehensive view of the whole may be had.

Along the central aisles, looms for cotton, wool and silk weaving are prominent. Perhaps the whole Fair does not offer a single stronger contrast than that between the Jacquard looms which produce pictures in silk—the Signing of the Declaration of Independence and others—and the little hand looms at which women in the Indian Encampment are weaving.

But the machinery of which I write stands off the main thoroughfares, in the annex and along the outer aisles of the hall, in places too obscure to satisfy some of the exhibitors. The men in charge I found uniformly polite, and so ready to give information and documents about the exhibits that I was constantly tempted to linger longer than my time allowed.

Near the north entrance the problem of ventilation has a solution offered in the exhaust fan manufactured by the Andrews & Johnson Co., of 241-247 South Jefferson Street, Chicago. The fan is formed of six curved blades, shaped like oars and inclosed in a round casing; it is attached to a compact Johnson high speed engine. The fan exhausters vary in size from a diameter of 18 inches to 108 inches. The advantage which this has over other exhausters, as stated by the manufacturers are: "(1) The small power required to run it and its safety. The fan being inclosed by a framework, the arms of which are made of the best malleable iron, the possibilities of an accident are reduced to a minimum. (2) Its convenience in application. Owing to peculiar construction of the frame it can be placed at either end or in the center of a pipe, in a wall, window or door, and can be run horizontally or perpendicularly, as circumstances may require. (3) It is *noiseless*, and offers when in motion no obstruction to the light."

The Johnson engines, to which the fans shown in operation are attached, are described by their makers as "noiseless, durable and effective, self-oiling and very powerful, closed tight and occupying very little space."

It is claimed that these fans can be used to advantage in all manufactories, school houses, mines, grain elevators, foundries, in fact, in any building where there is difficulty in removing impure air, foul odors, or dust.

A fan of 36 inches diameter, with an engine of from ¾ to 2 horse power, makes from 400 to 900 revolutions a minute and exhausts from 12,000 to 26,000 cubic feet of air a minute. The apparatus has been in use for seven years, and has been placed in such buildings in Chicago as the Meriden Britannia Co., 147 State Street; Manual Training School, Monroe Street; *Inter-Ocean* press room; Carson, Pirie, Scott & Co., dry goods store, and hundreds of other buildings in the city and in towns of the Northwest. From many sources most satisfactory testimonials to the efficiency of the apparatus are printed in the pamphlet which the firm gives to those interested.

In the English section the exhibit of the Economic Smokeless Fire Co. deserves notice. It shows ranges, stoves, and other heating apparatus to which Leggott & Marsh's patents for consuming smoke are applied. The invention consists in having a "baffle" in an inclosed fire chamber, dividing the chamber nearly from top to bottom. Adjustable "louvres," which can be opened or closed, are placed in the front of the chamber or grate. "Air is admitted to the fire mainly at the front, the fuel being fed on top of the fire. The draught being downward, the products of combustion are drawn through the fire, where the smoke-producing agents are consumed, the resultants together with the heat passing under the 'baffle' into a hot air chamber behind it and thence into the chamber." The "louvres" are moved by levers on the outside. The stoves or heaters are adapted to the use of the cheapest grades of coal. The *Lancet* last year appointed a commissioner to investigate the apparatus, and the following analysis of the soot from a chimney where it had been used is his:

Moisture	0·70 per cent.
Carbon	7·20 "
Hydrogen	0·23 "
Mineral matter	89·15 "
Nitrogen (partly in ammonia) and oxygen	3·42 "

The analysis of soot of a chimney where an ordinary range was used, he found as follows:

Moisture	6·68 per cent.
Carbon	76·76 "
Mineral matter	16·68 "
Nitrogen (ammonia)	6·36 "

There are 1,500 of these heaters in use in Great Britain, and from every quarter comes evidence of satisfaction with their working. Mr. W. T. Stead, editor of the *Review of Reviews*, is so well known in this country that his testimony is especially worth having. He says: "If this patent acts as satisfactorily when applied to other fires as it has done when applied to my own kitchen range, the days of fog are numbered. It is simple, efficient, and as economical as a kitchen range, and it consumes its own smoke. The principle of this stove is very simple; it consists in having the chimney at the bottom of the fire instead of the top. The products of combustion must pass through the hottest part of the fire, and in this way the smoke is consumed."

Although our heating appliances are, in general, superior to those which have in years past been made in England, with the best of ours there is so much waste and damage from the unconsumed carbon that it is to be hoped that these stoves will have fair trial here.

The Moore Carving Machine Company are in Section 14. Their first patents were taken out in 1888, and now there are 400 of their machines in use. They are made in Minneapolis. From a pattern cut by hand in wood, or from a plaster cast of such a carving, four exact copies may be cut at a time on this simple apparatus. To the novice it seems like magic. The machine requires only six feet of floor space, as the five tables upon which the work is done are arranged one above the other. The hand carving or cast rests upon the middle table. The operator looks at that, and works one or both of the cutter heads above and below him. These cutter heads have what is called a hand movement, and hold bits of various sizes. The carvings may be made in oak or mahogany as well as soft wood, and in a piece 30 inches wide, 6½ feet long and 2 feet thick I saw beautiful heads and groups of children from the antique which were cut on the machine. The pattern in hard maple, made by an artist, cost $100; the reproductions on the machine cost $1.25. They are improved by having a hand carver go over them with his tool to smooth them and work up the delicate details.

Two hundred of these machines are now used by manufacturers of furniture, pianos, etc. The machine is also adapted to other work, such as mortising, grooving, paneling, etc.

Another invention for bringing beautiful woodwork within the reach of people in moderate circumstances is a new one by W. W. Grier, of Hulton, Pa.

He calls his process *ingraining*. His apparatus consists of a hollow cylinder 10½ feet in circumference, to which the grain of a piece of oak of the width of the cylinder has been transferred. This grain is covered with a soft cement, which sinks into the depressions, and in these about 200,000 bits of metal like type are set. A small, smooth steel cylinder adjustable to different heights is placed above this. Between the two cylinders, both revolving, a piece of birch, poplar, bass, spruce or maple may be passed. It comes out with the grain of the oak transferred to it. It is then passed between two other steel cylinders, one revolving in a trough containing a liquid consisting of oil, coloring matter and another ingredient which is the inventor's secret, used as a "filler." The wood is afterward polished and varnished and looks like choice quartered oak. It can be sold at 40 per cent less.

Mr. Grier is also the inventor of what he calls the *ideal* door, which, he says, is "unwarpable, untwistable and unshrinkable."

He exhibits doors of this kind and also sawed sections of them, showing that they are five-play where most strength is needed. They are veneered with the ingrained lumber, and are 50 per cent cheaper than the ordinary oak door made with mortise and tenon. Thousands of acres of basswood in Michigan and Wisconsin, some of the trees five feet or more in diameter, can by this process be changed into the semblance of hard wood.

Across the aisle from this exhibit, which I should have said is at Column E. F. 53, in the annex to Machinery Hall, is that of the Norton Emery Wheel Company, of Worcester, Mass. In a case specimens of corundum are displayed; yellow from Georgia, dark red from the island of Naxos, shades from gray to black from North Carolina. All of these kinds are used for the wheels, large and small, which the company manufacture. The chief source of the supply of emery is Chester, Mass.

The most important exhibit of the annex is the paper mill. To Mr. J. F. Waggoner, the publisher of the *Paper Trade*, is due the idea of putting up the mill, and Mr. H. A. Frambach, of Kaukauna, Wis., who owns several paper mills in that place, superintended its construction. Forty-five manufacturers have contributed machinery for the plant, and it is supposed to comprise the very best that has been made for the manufacture of paper from wood pulp.*

The raw material used is of two kinds: 15 per cent is poplar prepared by the sulphite process and 85 per cent is spruce. It is brought by the car load to the building, dropped upon a conveyer, built by the Jeffrey Manufacturing Company, of Columbus, O., and carried to a storeroom under the mill. From this roome it is brought through a trap door to the beaters. There are two of these machines in use, both of new design, built by the Downingtown Manufacturing Company, of Downingtown, Pa. A 1,000 pound beater is placed on its edge. "A 48 × 48 inch roll in the middle of the engine acts simultaneously upon two bed plates, one at the top, the other at the bottom of the roll. The bottom bed plate is fixed, as in the ordinary engine, and the roll is hung upon very heavy arms at each side, with suitable means of adjusting its height to the bottom bed plate. Attached to the pillars which carry these arms are two others, which support the top bed plate." The roll is adjusted to the bottom bed plate, in setting the machine, and the top bed plate is adjusted to the roll. The roll is kept exactly midway between the two plates; a hand wheel moves roll and top bed plate at the same time. The engine is of iron and very compact.

The water used is first purified by passing through a gravity filter made by the O. H. Jewell Filter Company, and is pumped into the engines by a Gould's triplex pump. The stuff chests measure 10 × 12 feet and have cypress tanks. They were built by the Williams Manufacturing Co., of Kalamazoo, Mich. Their capacity is 2,000 pounds. The agitators which they contain were made by Richard Smith, of Atlantic, Mass. A reversal of the turbine principle is used in them: a single casting on a vertical shaft, and carrying buckets, keeps the stuff constantly and evenly in motion.

A rotary stuff pump made by the Morris Machine Works carries the stuff to a Marshall refining engine. From the other stuff chest, the stuff is carried to a mixing box, by a Gould triplex pump. From the box, the stuff goes to a screen made after their noiseless rocker pattern by the Valley Iron Works, of Appleton, Wis., and to another made by Baker & Shevlin, of Saratoga, N. Y., according to a new design called the bellows screen. The two screens are thus brought into the closest competition. The screen plates, nine in number, with 0·016 inch openings, are made by the Western Screen Plate Works, of Appleton, Wis. The Beloit Iron Works furnished the machine, and it has some absolutely new features. The Fourdrinier with 50 rolls and 50 foot wire is 112 inches wide.

The deckle frame, slice and pulleys of aluminum, is so light that two men can raise it from the machine. The rubber-covered couch and press rolls were supplied by the Revere Rubber Company, of Boston.

The driers, seventeen in number, are in double stack, nine below and eight above.

Radiation of heat is prevented by having the ends covered with iron and an air space left between the jackets and heads. The first roll is a 24 inch drier, so that the drying begins as soon as possible. The oiling is done after an approved automatic method.

The first calender is a five-roll stack and it is followed by a nine-roll super-calender, with rolls hung in boxes which slide on the frame, leaving one side perfectly free to remove or insert rolls. The calenders were made by the Farrell Foundry and Machine Company, of Ansonia, Conn.

The reel has six rolls; the slitter, which has a rubber feed roll, was made by the Bess Machine Company, of Hamilton, Ohio, and the winder is a Manning. Convenient accessories to a model mill have been furnished by a dozen other firms.

The product, about 125 tons a month, is smooth, white close paper, and is taken by the *Inter-Ocean*.

Mr. Hillis, the gentleman whose chief business is to show the working of the plant to interested visitors, is most explicit in his explanations, and the men who are engaged in operating the machinery answer questions with exemplary patience. It is certainly a most valuable exhibit, not only for paper makers but for people in general, who cannot fail to learn something from an object lesson which contains so much.

A beautiful feature of Machinery Hall is a great basin into which streams of water are pumped at many angles, some rising to considerable height. It is in fact an exhibit of pumps and hose, but has all the refreshing effect of a fountain.

Near this are several exhibits of steel tools. Here are great cases of saws—band saws, from those of a

(*Continued on page 230.*)

* The details about the mill and the quotations which I make are from a copy of the *Paper Trade*, in which it is minutely described.

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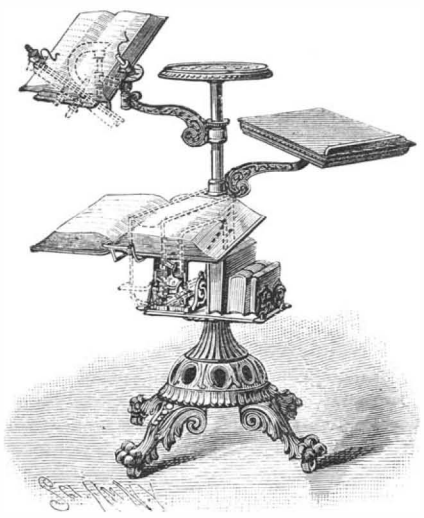
A CONVENIENT READING STAND.

The improved stand shown in the illustration has been patented by Messrs. Francis J. Anderson and William M. Irick, of Gainesville, Texas. It has preferably two reading desks, the top one readily adjust-

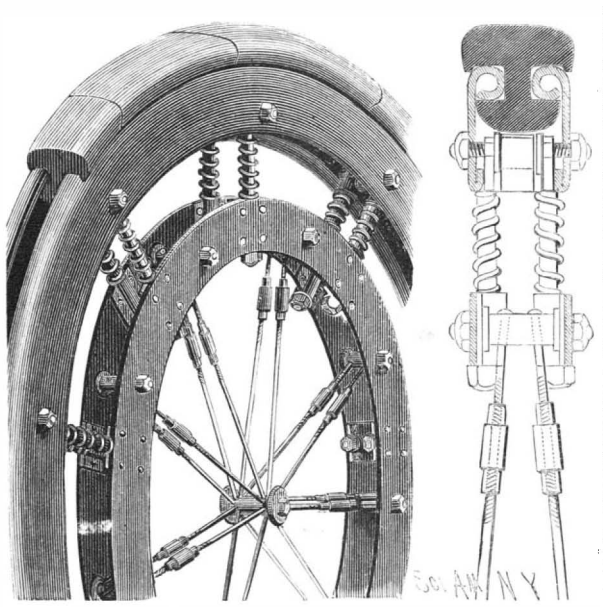


ANDERSON & IRICK'S READING STAND.

able to hold a book inclined in any desired direction, either upward or downward, to accommodate one reclining on a sofa or sitting upright, while the other desk may be used to hold a reference volume, or for writing, as may be convenient when a consultation is being held. The stand also supports, lower down upon its standard, a case or rack for the reception of books and magazines, and a novel form of dictionary holder, the dotted lines in the illustration representing the dictionary in closed position in the holder. By pulling up on a handle of the holder it rises and opens out to hold the dictionary in position for reference, as shown in full lines, the book being closed and returned to its place at the side of the standard with equal facility. At the upper end of the standard is a table which may be used to support a lamp, and the two reading desks are supported by brackets sliding upon the standard and readily adjustable at any desired height thereon. Upon an extension of the upper bracket is a special construction of clamping and adjusting mechanism whereby a book may be readily held open, in the most convenient position for perusal, whether one is standing, sitting, or lying down. Either one of the desks may be adjusted independently of the other.

AN IMPROVED WHEEL FOR VELOCIPEDES, ETC.

The illustration represents, in perspective and cross section, a wheel designed to be strong and durable while also well adapted to promote smooth riding. The improvement has been patented by Mr. Jules Roussat, of Paris, France. The rim of the wheel consists of two side plates held a proper distance apart by short bolts or rods, and inclosing between their outer edges a band or tire of double T shape, which may be of either the cushion or pneumatic type. This tire is preferably formed in sections to facilitate repairs and the substitution of new sections. Rods surrounded by spiral springs and having a sliding connection with the outer rim are also connected with the plates of an internal concentric rim through sleeves riveted upon



ROUSSAT'S CYCLE WHEEL.

the inside of the latter, to allow for a limited degree of bending or compression upon the external rim. The metal spokes are each formed of a pair of rods secured at their inner ends to the hub in the ordinary manner, but their connection with the inner rim is through oppositely threaded sleeves or nuts, operating as turnbuckles, in the opposite ends of which are screwed short rods or stems connected with the rim, whereby the spokes may be readily tightened by turning the sleeve.

Further information relative to this improvement may be obtained of Mr. A. Bourgeat, No. 163 West Houston Street, New York City.

The Sorghum Sugar Industry.

In a recent report to the Secretary of Agriculture, Dr. H. W. Wiley, chemist of the department, stated, since 1888 there had been $20,723 expended at the Sugar Experiment Station at Sterling, Kan., and $40,024 at Medicine Lodge, Kan., since July 1, 1890.

Secretary Morton is said to be considering how these expenditures can be reduced, and it becomes the duty of every friend of the American sugar industry to plead the cause of sorghum, that member of the trinity of American sugar-producing plants which, while thus far least successful, is far more promising than was the beet fifty years ago, and which to-day stands as the theoretical rival of tropical cane, and which only such investigations as Dr. Wiley has been carrying on at Sterling and Medicine Lodge, supplemented and enlarged, we may say, by those carried on by our own distinguished and public-spirited citizen and planter, Mr. Daniel Thompson, at Calumet, can make a practical success.

Sorghum cane can and will produce sugar in large quantities. This has been demonstrated in Kansas. There are practical difficulties in the way that, under the enlightened system undertaken by the Department of Agriculture, are being removed one by one. Kansas is an immense State, and a State of *farms*. Agriculture is the dominant industry there, and the limited rainfall and absence of irrigating streams leads to the selection of such crops as need the least rain of all, and the best adapted to the dry climate. Alfalfa and sorghum became staple crops because of their capacity to flourish in the dry land of Kansas. Of these of course sorghum would become the great money crop if its conversion into sugar were made a practical as well as a theoretical success. To reach this end the Department of Agriculture has been experimenting a number of years, and while the goal has not been reached, the expected 200 or 300 grand sugar houses have not been erected in Kansas, and Kansas is not furnishing hundreds of thousands of tons of sugar to her sister States, yet the possibility of all this exists; we shall go further and say that the probability of it exists, and that sorghum has less to contend with to-day than had the beet fifty years ago, and now more than half the sugar of the world is made from the beet, the suspected, discredited, ill-flavored sugar plant that struggled into industrial recognition during the first half of this century. Give sorghum a chance, let the government investigate with it and experiment with it as European governments did with the beet, and we shall finally conquer this refractory plant that tantalizes us with 16 to 18 sugar per cent in analysis while yielding but 4 or 5 per cent in the factory, and Kansas will gain the best crop her vast areas of land can be devoted to.—*La. Planter.*

On the Chicago Flier.

The Chicago flier is not driven by one but by many engineers, says a writer in *McClure's Magazine.* In order to cover the 964 miles between the two cities in twenty hours, including nine stops, there are required seven huge engines in relays, driven by seven grimy heroes. A run of less than one hundred and fifty miles is the limit per day for each engine, while three hours of the plunging rush wears out the strongest engineer. Sixty, seventy, eighty miles an hour—what does that mean for the man at the throttle? It means that the six and a half feet drivers turn five times every second and advance 100 feet. The engineer turns his head five seconds to look at the gauges, and in that time the terrible iron creature, putting forth the strength of a thousand horses, may have shot past a red signal with its danger warning 500 feet away. Ten seconds, and 1,000 feet are left behind—one fifth of a mile. Who knows what horror may lie within that 1,000 feet! There may be death lurking round a curve, death spreading its arms in a tunnel, and the engineer must see and be responsible for everything. Not only must he note instantly all that is before him, the signals, switches, bridges, the passing trains and the condition of the rails, but he must act at the same moment, working throttle, air brakes or reversing lever, not as quick as thought, but quicker, for there is no time to think. His muscles must do the right thing automatically under circumstances where a second is an age. In the three hours of his vigil there are 10,800 seconds, during each one of which he must watch with the mental alertness of an athlete springing for a flying trapeze from the roof of an amphitheater, with the courageous self-possession of a matador awaiting the deadly rush of a maddened bull; and far more depends upon the engineer's watching well, because if he fails by a hair's breadth in coolness or precision of judgment, there may come destruction, not only to himself, but to hundreds of passengers, who, while he stands guard, are perhaps grumbling at the waiters in the dining car or telling funny stories in the smoker.

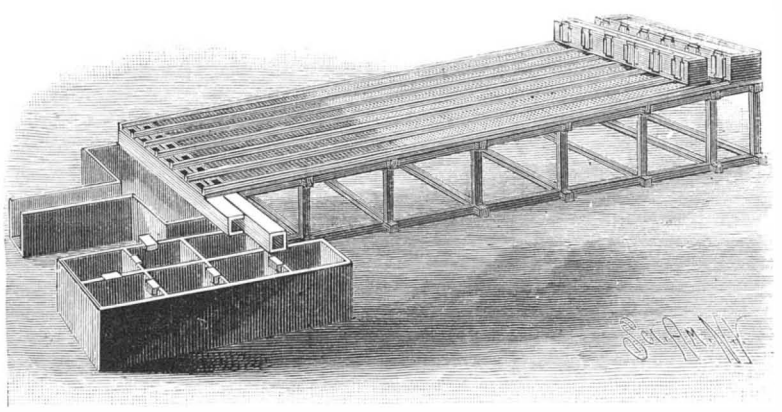
"What would you do in a collision?" I asked.

The engineer pushed back the little black skullcap from his iron-gray hair and said:

"It is pretty hard to say what a man should do when he hears the whistle of danger ahead or sees that a crash is coming. Even the best of us are liable to get confused at such a moment. What would you do if you woke up in the night and found a burglar holding a pistol at your head? There are no rules for such cases. What I would not do, though, is to reverse my engine, although many engineers are liable to lose their heads at a critical moment and make that mistake. It is a curious thing that reversing your engine suddenly when going at high speed makes the train go faster instead of slower. The reason is that the drivers slip and the locomotive shoots ahead as if she were on skates. The only thing to do is to put on the air brakes and pray hard."

AN IMPROVED CONCENTRATOR.

This is an apparatus of simple and durable construction, designed to save the precious metals and the floured quicksilver passing with the tailings discharged from the mill. It has been patented by Mr. D. W. Humphries, No. 115 Twenty-third Street, Portland, Oregon. At the upper end of a slightly inclined table of suitable length is a receiving tank or receptacle having in its front side gates through which the tailings are discharged into channels on the top of the table, each channel having its bottom covered in the upper part with a coarse mesh fabric, such as jute, a fabric of finer mesh, such as canvas, being used near the lower end of the table. At the lower end of each channel are two valved



HUMPHRIES' ORE CONCENTRATOR.

apertures leading into two transverse channels, the first one of which discharges into a tank connected by overflows with a series of tanks, the last one of which discharges into a waste chute. The second transverse channel discharges into a tank for receiving the lighter second-grade concentrates. At the lower end of the table is a tailing box, a chute from which carries off the refuse sand and water. In front of the receiving box, near the upper end of the table, is a water-distributing box, supplied from any suitable source, and having gates through which the water is permitted to flow as desired into the respective channels. In operation, the tailings are allowed to flow down the channels until they are well distributed over the table, when the gates of the water box are opened one at a time, and sufficient water passed through to carry off the sand only, the attendant sweeping the channel for a portion of its length with an ordinary mill broom. The valve of the lower transverse channel is then opened, the water supply increased, and the sweeping resumed, when the lighter or second-class concentrates are carried off to their tank, the finer fabric at the lower end of the table not detaining them. The valve communicating with this tank being closed, and the other one opened, the sweeping is continued, and the heavier concentrates are carried in the same way to the first of the series of overflow tanks, each channel being swept in a similar manner.

To Keep Ants Away.

Rub a light film-coat of balsam Peru around near the bottom of table or kitchen safe legs—just a narrow band will do—and renew the balsam every two or three weeks. This will keep ants away from tables, kitchen safes, etc., and what they hold or contain; provided there is no other ant-way than up the legs.

One drop balsam Peru spread around the upper part of a sirup bottle will keep the ants away for months.

Boil one ounce balsam Peru in one gallon rain water for half an hour, and sponge this water, while hot, over wooden floors and walls, and it will keep ants away for a long time.

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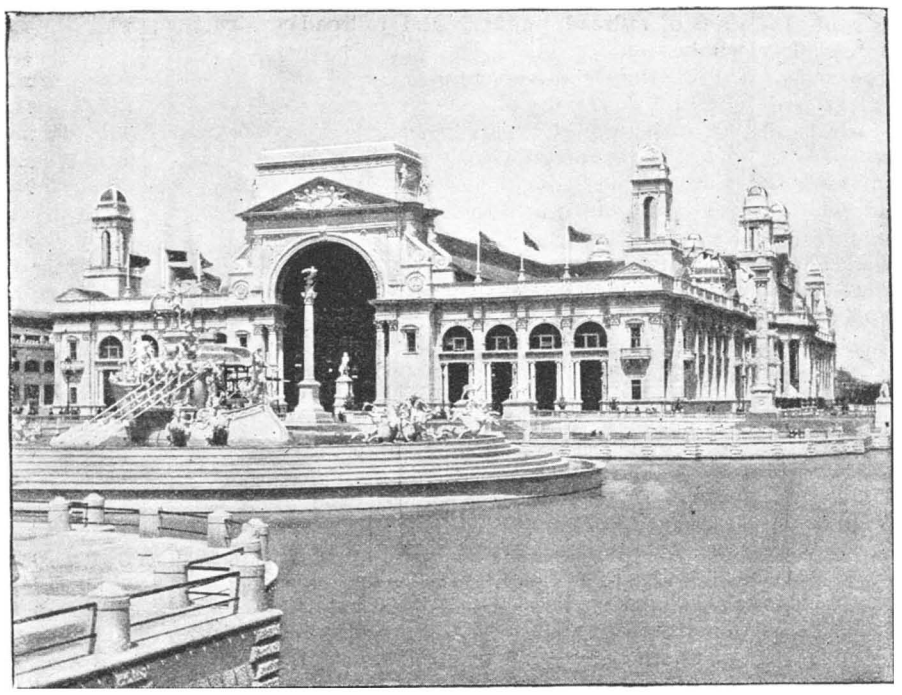
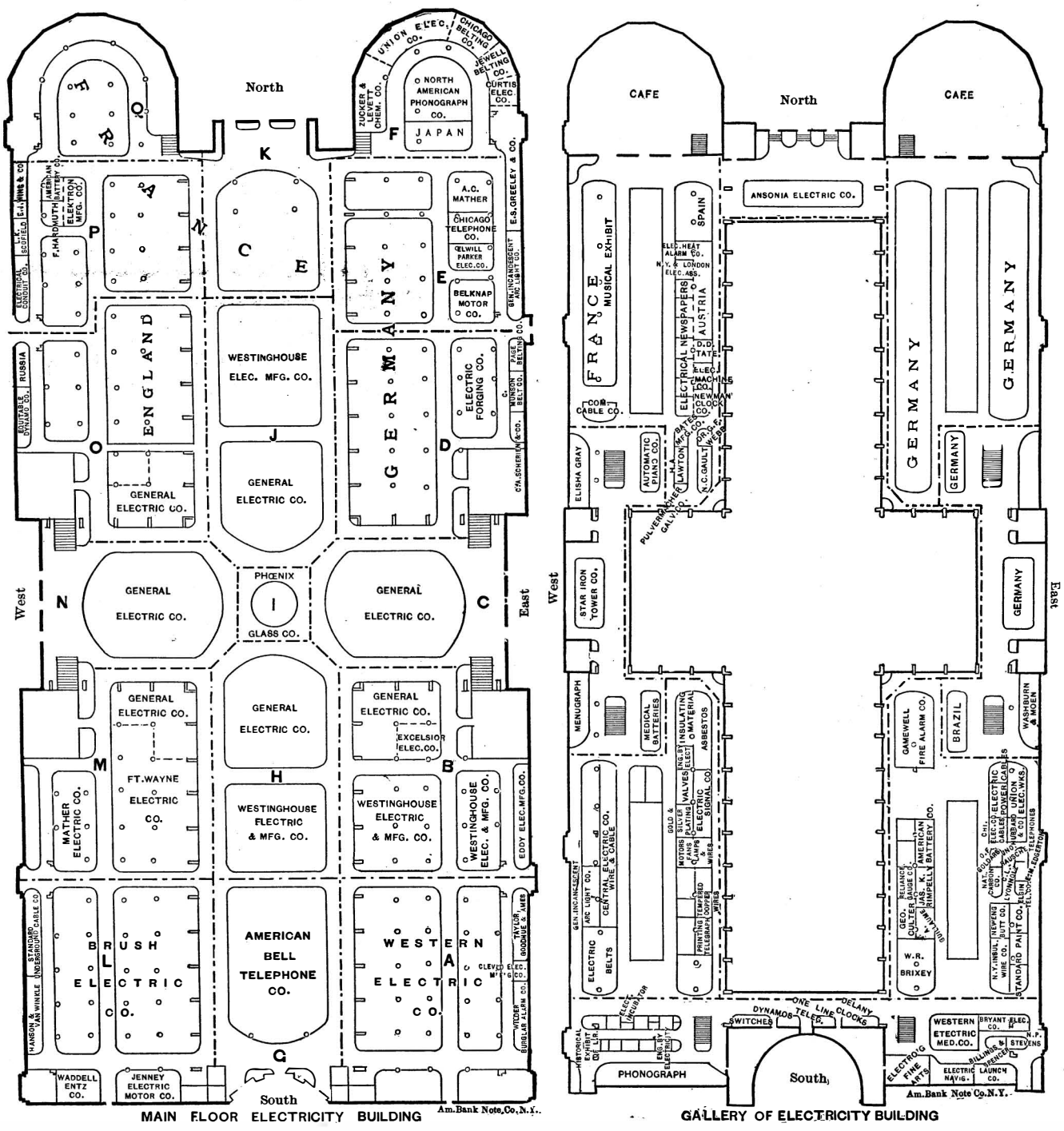
THE ELECTRICITY BUILDING AT THE FAIR.

The Palace of Electricity occupies a peculiarly fortunate location between the palaces of Manufactures and Mines. The Electrical Palace is one of the most popular on the grounds and is thronged with visitors day and evening. The architects were Messrs. Van Brunt & Howe, of Kansas City, and the composition is very creditable, most of the detail being derived from the science of electricity itself, the conventional detail being relieved by repetitions of the lamp, electro-magnet, etc. The Electricity building is about the same dimensions as the Mines building, but is much more ornate. Our view represents the southern façade, which is very fine. Corinthian pilasters support the heavy cornice. The main entrance is toward the south and consists of a pylon pierced by a triumphal arch 92 feet high, which forms the frame of a hemicycle with polychromatic decorations. This hemicycle or niche affords an effective background for Carl Rohl-Smith's successful statue of Franklin, who is clothed with all the majesty of the discoverer as he holds the key with which he unlocked the great science. The sky line is broken by ten towers and four domes. The caps to the towers are gilded. The north end is more irregular, as it does not face the Court of Honor, where a certain unity in the style must be preserved. Two large apsidal or semicircular projections terminate the sides of the north end, adding to the picturesque effect. Our plans of the main floor and gallery show the location of the various exhibits. Entering the building from the south, the first exhibit is that of the American Bell Telephone Co., who have a small central station installed in a neat pavilion. Visitors pass along in front of a miniature switch-board; the complicated connections and the wires as they pass into a subway are shown through iron gratings. At the right is the exhibit of the Western Electric Company, which includes many whirling devices mounted with incandescent lamps with globes of various colors. The well known specialties of this house, such as switches, central station instruments, are well shown. The exhibits of both the General Electric and the Westinghouse companies are very complete, though of course to see the great dynamos in operation a trip must be made to Machinery Hall, where steam power can be obtained. Such power as is needed in the Electricity building is furnished by electric motors. The Brush, the Fort Wayne Company and others make attractive exhibits; but probably the most interesting, certainly the most beautiful, exhibit in the building is the Edison Tower of Light, built by the Phœnix Glass Company. From a colonnade thirty feet in diameter rises a shaft seventy-eight feet high studded with thousands of electric lamps an inch and one-half long, with different colored globes arranged so that they will flash in various designs and colors. The column, which is a reproduction of the German Tower of Victory in the Thiergarten of Berlin, is surmounted by an enormous incandescent lamp composed of pieces of cut glass. The lamp is eight feet high and 3,000 pieces of glass entered into its construction. The exhibit of foreign nations at the north end is very fine, especially in the line of test instruments. The gallery contains many of the smaller and lighter exhibits, such as test instruments, fire alarms, etc.





THE WORLD'S COLUMBIAN EXPOSITION—THE ELECTRICITY BUILDING.

A New Port for Buenos Ayres.

The national government of the Argentine Republic and the provincial government of Buenos Ayres have granted concessions to Messrs. Gibson & Co. to construct a port at San Clemente, Cape San Antonio, in the province of Buenos Ayres, and railways to connect the port with the existing railway system, which will bring the new port within 200 miles of Buenos Ayres. The estuary of the La Plata is 28 miles wide at Buenos Ayres and 65 miles wide at Monte Video; but owing to the enormous quantity of matter held in suspension by the great river, the estuary has in time become clogged up so as to seriously interfere with the commerce of Buenos Ayres, the capital of the Argentine Republic. Ships drawing only 15 or 16 feet of water are obliged to anchor seven or eight miles from the city or even more and discharge their cargoes into shallow-draught lighters—an inconvenient and expensive transfer. Millions of dollars have been spent on the port works, but the rapid silting up of the channel and the irregularity and uncertainty as to the amount of water in the estuary has rendered the expenditure almost useless. At last it has become a question of cutting and keeping clear a channel of immense length or using a new port. The projected port is at San Clemente, Cape San Antonio, at the south-eastern entrance to the Rio de la Plata.

Although the vessels engaged in the South American trade are not of the largest size, still the probable development of ocean navigation as regards draught must be considered when a new port is to be built. San Clemente will be provided with sufficient depth of water in the channel and harbor to admit vessels of the largest size existing and those likely to be built in the near future, for San Clemente may be used as a coaling station for men-of-war. The first section of the projected works includes an entrance channel having depth of 29·5 feet at low water and 34·4 feet at high water. The breadth at low water is to be 311 feet. A mole, 5,578 feet long, will inclose the harbor on the west. Other quays are to be built. There is no special difficulty with the railways, which it is hoped will open up a large and fertile zone of the province. The commerce of the Argentine Republic will, without doubt, be largely increased when the scheme materializes.

Petroleum in Peru.

The wells are situated at Talara, about 40 miles north of Paita, and are under the active management of Mr. Herbert Tweddle, Jr., who was formerly connected with the American Standard Oil Company. Mr. Tweddle has been interviewed recently, and has made known facts which are of general interest. He says the company's lands comprise an area of about 1,000 square miles, the oil region extending for 200 miles north of Talara, and inland for a distance of 16 miles. The first well bored by Mr. Tweddle yielded at the depth of 300 feet a flow of 180 barrels of petroleum daily. Up to the present time they have drilled twenty-six wells, finding oil in every instance. The company are now handling about 100 tons of crude oil per day, the possible output being about 100 barrels per day per well. The depth at which the oil is found is not over 500 feet, whereas in the United States the depth is from 2,000 to 3,000 feet. The distilled product is sold along the coast, while the crude oil has a large sale at Callao for use by the gas companies, for stationary engines, and for the railway locomotives, as a substitute for coal, than which it is 40 to 50 per cent cheaper.

THE Union Pacific has fifteen long and a great number of short tunnels, the aggregate length being 6,600 feet.

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Notes from the World's Columbian Exposition.

(*Continued from page 227.*)

quarter of an inch wide to those eight inches wide, arranged on great pillars covered with velvet; circular saws of many sizes, some of possibly five feet in diameter, are revolving. A person who has not seen them will hardly believe it, but they are really beautiful.

Henry Disston & Son's File Company, of Philadelphia, show a great variety; among them are band saws of aluminum steel.

The exhibit of E. C. Atkins & Company, of Indianapolis, Ind., has many interesting features. The arrangement of the saws is perhaps more artistic than any of the others. The five great columns in their case all turn the twelve inch band saw, which goes around them all, apparently serving as a belt. Each column carries a different kind of saw; the entire length of those on one is 912 feet.

They have an interesting relic in the shape of a mulay saw made fifty years ago by the firm. It was used in a mill in Wisconsin, until it was burned; last winter a new mill was built, and the old mulay, after having been buried twenty years, was brought to light, rusty but intact. It is six feet long and has seventeen teeth. Quite a contrast between this and the sixteen foot saw made by this firm on purpose to bring down the big tree which the State of Washington has in its building!

The most artistic feature of this rare exhibit is an American flag with its stripes composed of alternate copper and steel saws and its stars of small circular saws on a blue steel field.

These saws make one determined to be at the saw mill, just beyond Machinery Hall, at 2 o'clock, when it is in operation. I was just too late to see the day's work done, but the foreman was kind enough to show me the apparatus and to give me some valuable facts. The mill was built by the Edward P. Allis Co., of Milwaukee, after their most approved methods of band mill making. The great band saw was made at Beaver Falls, Pa., and is 45 feet long and 12 inches wide. A log is cut into 10 foot boards in three minutes. The capacity of the mill is 60,000 feet of lumber, or 6 car loads, in 10 hours.

This company's business consists in erecting mills, often six times as large as this, in different parts of the country. Within the past year they have put up a number in the South. All the principal officers of the company have been at the Fair, and they have taken a number of contracts.

In this building, the Novelty Iron Works Company, of Dubuque, Ia., have shingle and lath machines which are not in operation, on account of some failure in power. It is but a step from the saw mill to the Michigan Logging Camp. This is built of split logs, the chinks filled with plaster, and is in two rooms with a sort of passageway between. The first room is at one end a kitchen with its great stove and cooking utensils hanging from the walls; the other and larger part has two long tables set with tin dishes and pewter cutlery. The walls have upon them many interesting photographs of scenes in the camps in winter.

In the other room, the men sleep in bunks arranged three deep along the wall. The idea of lumbering in those great northern forests is made complete by the enormous load of logs close to the door of the camp. There are fifty white pine logs, all 18 feet long, weighing 144 tons. They were hauled on the very sled upon which they now rest, by the estate of Thomas Nester to the Ontonagon River. One pair of horses drew them on an ice incline prepared for the purpose, after the men, by pushing at the rear, had started them. The are held together by very heavy chains.

The saw mill is a sort of supplement to the Palace of Mechanical Arts, to which I have given the simple name Machinery Hall, and logging camp, called the Michigan Outdoor Exhibit, seems a natural adjunct to the mill. Interesting and unique as they are, comparatively few people find their way to them, if I may judge from the numbers who visited them when I did. They deepen the impression which one gets at every hand that the Fair represents untiring energy, marvelous ingenuity, and the accumulative thought of many centuries.

A New Yorker's Impressions of the World's Fair.—Having spent nearly a day in obtaining a general view of the grounds and buildings, by the aid of the electric launches and one or two rides around on the Intermural electric railroad, and familiarized one's self with the geography of the place, the question is asked of persons who have spent two months or more on the Fair grounds, What is the most interesting building to enter and see first? The reply is in the shape of another question, What subject are you most interested in, as we have a wonderful variety of things to see? Such is really the fact. But something of special interest will be found in every building.

As the visitor is brought to the Fair by the aid of steam, naturally the development of this perfected method of transportation leads one to inspect the exhibits in the Transportation building, which stands near the Sixty-fourth Street entrance, one of the best in the Fair because of its great width.

To see in one building the remarkable variety of all sorts and forms of railroad, carriage, marine and primitive appliances for transportation from all parts of the world is to gain a vast amount of information in an incredibly short time. One day can be most profitably spent here. If the south end of the annex building is entered first and a northward direction followed, traveling east and west through the long lines of exhibits, a most instructive sight, illustrating the progress of railroad building and railroad construction, will be seen.

From the primitive mountain wood railway, made of round wood poles placed end to end, and a rough car, with grooved wood wheels, scarcely a foot in diameter, to the magnificent Pullman palaces, is but a step. Yet one sees the various degrees of improvement as naturally as if there had been some general design.

When the use of iron is begun for the manufacture of rails, they are about two feet long, resembling very much a cast iron grate bar spiked to cross ties of wood at short intervals. Comparing these with the mammoth steel rails 100 feet long now used by the Pennsylvania Railroad is a great jump forward.

There are notable exhibits also of the modern construction of railways in different countries, showing quite a variety in roadbeds and the use of metal ties instead of wood. In some countries the joints of the rails are supported on stone.

Next in interest is the fine display of American locomotives of all types and styles; the new mammoth machines of the triple expansion style, being in operation by means of compressed air, attract many visitors and are the admiration of all, showing the skill and perfection America has reached in this branch.

Probably never will such a collection of locomotives again be seen. Adjoining the American exhibit are the German locomotives and cars; the latter are elegant specimens, and a drawing room car, open from end to end like American cars with a center aisle, is very luxurious. The sides above the seat line are nearly all plate glass, extending to the top of the car. Instead of having wire baskets overhead just under the roof of the car to hold light luggage, the back of the seat at each end of the seat is extended upward in the form of a light plated metal pillar high enough to be out of the way of the head, and which supports a box-shaped wire basket extending crosswise to the length of the car. The car was about a third shorter than the American cars. The German locomotive has the eccentric and valve gear arranged on the outside of the driving wheels instead of underneath, and under the boiler, as in this country. It is kept brightly polished and gives the locomotive more the appearance of a complicated machine than it actually is. They are very solidly built and the workmanship is of high order. A model of a steam carriage built by Sir Isaac Newton in 1680 is especially interesting. A collection of some twenty or more full sized models old style locomotives, exhibited by the Baltimore & Ohio Railroad, rivets the attention and illustrates perfectly the evolution of the locomotive.

In connection with this exhibit, on a long screen or division wall are hundreds of large photographs of scenery on the line of the road. The English locomotives present a striking appearance, being built very solid and with a single driver wheel, usually nine feet in diameter. There were two on exhibition and they attracted much attention. The French and Belgian locomotives are by themselves in the main building, but displayed no special peculiarity other than fine finish and massiveness. In almost all of the foreign locomotives the use of the American cab for the better protection of the engineer from weather, etc., was noticeable. In vestibule trains and automatic brakes the United States is ahead of all other countries.

Beyond the Great Britain exhibit cars and devices of various kinds are shown, including many styles of switches. There is a special heating and lighting car used on one of the roads leading out of Chicago, capable of supplying a train with 200 lights. In one end of the car is a dynamo and special steam engine, while the other contains a boiler for furnishing steam to the engine and for heating the train.

The modern helps for building railroads are shown, including steam shovels, cranes and dump cars. The novelty of the latter was in the pneumatic attachment underneath on the truck for automatically dumping the platform. The old-fashioned way in building an embankment is for men to run along by each car and upset it, one at a time. The new way is to have a train of construction cars connected with a special air pipe and enable the engineer with one turn of a faucet, by means of compressed air, to actuate all the car platforms at once, throwing them at an acute vertical angle, then, when the dirt is discharged, another movement of the faucet brings the platform back to a horizontal position.

The development and utility of compressed air as applied to railroad appliances is one of the special features shown in this building. The group of air brakes all connected up, shown by the Westinghouse Company, was quite interesting, and its application to freight trains of 100 cars was demonstrated. By certain appliances in the locomotive the engineer can throw the brakes on all of the cars at once, or can apply it to certain cars on the train.

In connection with signaling and switching apparatus, compressed air is shown to be a most important factor in facilitating work and saving time.

The great snow plows used in clearing the tracks on the long continental lines, looking like huge houses on wheels, are particularly instructive.

Electric street cars, cable cars, an ammonia car, and other similar vehicles are shown in considerable variety, while wagons, carriages, etc., are very numerous. In the north end of the main building are specimen one hoss shays, a carriage Daniel Webster is said to have used, a Spanish vehicle as used in Cuba, a Mexican cart and a Japanese jinricksha. Marine methods of transportation are shown in the main hall, including models of all sorts of vessels and a section of one of the great American steamships. In the gallery are bicycles of all descriptions and numerous models of canoes, boats and canals, including a model of the celebrated Forth Bridge.

Even in one day's visit to this building, there will be much that one will overlook. The royal gilded carriage of a Brazil emperor and the Lord Mayor's coach, of London, are interesting to see. Mexico supplies a model of a Mexican on a model horse, dressed in most elaborate saddle harness.

The perfected English systems of railroad signals and switches are also shown in actual size, and America's great Bethlehem Iron Works shows examples of work equal in magnitude and perfectness of forging to the work made by the celebrated Krupp. The full sized model of their immense steam hammer is one of the prominent objects in the main hall. Everybody should visit this building, and everybody who does, brings away thoughts of the wonderful progress that has been made in transportation and admiration of those who suggested the idea of getting together such a surprising and comprehensive exhibit. In our next other notable exhibits will be treated of.

The total number of paid admissions during the month of August was 3,515,493, and the total number to date (September 26) 13,831,597.

The Science of Nutrition as Exemplified at the World's Columbian Exposition.

BY H. C. HOVEY.

In the midst of the Revolutionary war, at a time when our fathers were in danger of starvation, a man emerged from a New England village, whose experiments have done more than those of any other savant, or possibly than all other efforts combined, to find the exact combination of materials and methods that shall give both to rich and poor the most wholesome and palatable food for the least cost. The Yankee name of this great reformer was Benjamin Thompson, a farmer boy, a shop clerk, a school teacher, a soldier, a statesman, a philosopher, a nobleman, but above all, a cook. The name by which he is best known is that of the Count Rumford, a title chosen by himself from the name of the American town where he had formerly resided; but the rank was conferred by the Holy Roman Empire. His essays on the "Science of Nutrition," published by the American Academy of Arts and Sciences, contain the results of his costly and elaborate experiments in London, Munich, and elsewhere. He tells us that he was led to his peculiar line of research by observing that the Bavarian soldiers, who were remarkably strong and healthy men, and very fond of eating, contrived to live on very small sums of money, and yet enjoyed savory, nourishing, and highly palatable food. If they could do this, he reasoned that the secret of the art was "as important as anything that could employ the attention of the philosopher." To give an idea of the energy and magnitude of his operations, the fact is stated that he once had 2,600 beggars and outcasts arrested by the military patrol of Munich and transferred to an industrial establishment, where he could try his plans for making them healthy and happy.

In honor of this philanthropist the Rumford Kitchen is named at the World's Fair, where are exhibited models of his inventions, a complete library of his works, as well as much general literature on the application of science to cookery, a kitchen laboratory with all needful apparatus and utensils, and charts and diagrams illustrating culinary methods. Nothing is cooked for the sake of being sold; but samples of food are prepared and served at cost at a limited number of small tables. The meals thus offered are so popular that those are fortunate who manage to get a seat by patient waiting. Menus are printed giving ten standard luncheons from which a choice may be made for the day. There is a printed table giving the cost of the raw materials at market prices. The food values of the various dishes are also stated, giving the weight in grammes of the proteids, fat, and carbohydrates contained in each meal, and the resulting calories. So many scientific terms perplexed some of the customers.

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A well-dressed lady remarked to the writer that it was well enough to tell people how many proteids and the like could be seen in food by the aid of the microscope, but for her part she preferred not to know that they were there!

As an example standard luncheon No. 2 weighed 20 ounces, and included ten ounces of escalloped meat, four of bread, seven-tenths of an ounce of butter, and five ounces and three-tenths of apple sauce. This represented in grammes, of proteids 32·2; fat 26·8; carbohydrates 138·8; calories 942·5; and the cost of raw materials was six cents, while the price asked for the prepared luncheon as served was thirty cents. This interesting exhibit of domestic science is under the direction of Mrs. Robert H. Richards and Mrs. J. J. Abel, M.D., and is in connection with the Bureau of Hygiene and Sanitation, as part of the Massachusetts exhibit. The ladies named give more ample details of their purpose and methods in "The Story of the New England Kitchen," a pamphlet full of new and valuable information concerning experiment stations in Boston.

Immediately next the Rumford Kitchen is a similar institution known as the New York Cooking School Exhibit, under the personal direction of Miss Juliet Corson. This lady, so far as is known, was the first person in America to give cooking lessons as part of the curriculum in the education of girls. The writer, therefore, regarded it as a privilge to hear what she had to say concerning the subject under consideration. To begin with, however, Miss Corson paid due tribute to the diet kitchens founded during the war, at Washington and elsewhere, by Mrs. Annie Wittenmeyer, which revolutionized the preparation of food for the sick and wounded in our military hospitals. Mrs. Wittenmeyer also published a book on the subject with special instructions for army nurses. But this work was to meet an emergency, and was accordingly transient.

Some twenty years ago, when the hard times following Black Friday made it difficult for many people to secure the ordinary comforts of life, Mr. James Gordon Bennett, Jr., started soup kitchens in New York City. He hired Rannhofer, Delmonico's *chef*, to manage them, on the principle of securing for poor people the best food at the lowest cost. At about the same time, or perhaps the previous year, certain prominent society women, among whom were Mrs. Judge Roosevelt, Miss Annie Newcomb, Mrs. A. M. Palmer and Mrs. S. C. Courtney, formed a training school for women in Miss Corson's residence in the old Rutgers block. Wheeler & Wilson gave them a number of sewing machines and also a cash donation. Work was obtained from the clothing stores, which was given to poor women at a fair price. Proofreading, shorthand, bookkeeping, etc., were taught gratis. The school was afterward removed to rooms at 625 Broadway, and at a later day to 47 East Tenth Street, where the rent was generously paid by Mrs. Elizabeth Thompson. From this point the work became popular, and all New York stood ready to help it forward.

In 1873 Miss Corson, who was both secretary and manager, got hold of the lectures that had been given at the London Exposition by Dr. Buckmaster on the chemistry of cooking, and resolved to try them in her training school. She first negotiated with an ex-cook of Governor Tilden's, a Frenchman, and as an experiment ordered him to prepare for four ladies a simple lunch. Such was this *chef's* idea of a frugal repast that the bare materials cost over $17. That would never do, and on further inquiry they found a highly trained French cook who also had proper notions as to economy, and they employed him to teach all who came for the purpose, rich or poor, how to cook all kinds of food, coarse or fine, delicate or common. The ladies themselves meanwhile studied the subject with great zeal, and Miss Corson traveled extensively, investigating local methods everywhere in their economical, sanitary and scientific relations. At their suggestion, in 1878–79 the United States Bureau of Education sent out circulars requesting from all sources all available information, and thus gained a mass of knowledge subsequently embodied in a cooking school text book.

Under the auspices of Hon. John Eaton, United States Commissioner of Education, and encouraged by Mrs. President Hayes, Miss Corson gave a series of lectures and practical lessons in Washington, D. C., attended by women of all classes, as well as by the girls in the high school and other institutions. Then the Ladies' Educational Association, of Montreal, under the patronage of the Princess of Wales, invited Miss Corson to do similar work there. The result was that scientific cookery was made a regular part of the education of girls in the public schools, in which they were examined as in other studies, and graded according to their proficiency. The next city where this plan was adopted, under the instruction of the same indefatigable teacher, was Oakland, Cal. During the last decade there have been numerous cooking schools originated by her in Chicago, Cleveland, St. Louis, Philadelphia, Baltimore, Hartford, Concord and Washington, as well as in the State Charities Hospital on Blackwell's Island, the city hospital of Brooklyn, and various other hospitals and sanitariums.

When it was proposed to have a model cooking school at the World's Fair, Mrs. Potter Palmer wrote to Mrs. J. S. T. Stranahan, of Brooklyn, vice-president of the New York State Board of Lady Managers, who suggested what has since taken shape as the New York State Cooking School Exhibit, under Miss Corson's personal direction. Here are shown daily, from 10 A. M. to 4 P. M., the best scientific and practical systems formulated as the result of twenty years' experience and investigation. Women are especially invited to use this opportunity to introduce novel methods of kitchen work and inventions in culinary art.

The "Corn Kitchen" is still another exhibit of the same general nature, though more especialiy intended to show the many uses of corn as a food. This is under the direct auspices of the State of Illinois, and is located on the second floor of the Woman's building. Mrs. Sarah T. Rorer, from the Philadelphia School of Cookery, has charge of it, and in addition to corn cooking, aims to illustrate every kind of kitchen work. Her lectures are so popular that the guards often often have to break the crowds that gather around the doors after every seat has been taken. The following order is observed: Monday, soups and other dishes, with meat for a basis; Tuesday, bread made with yeast; Wednesday, pastry, plain and fancy; Thursday, poultry, including dressing as well as cooking; Friday, waffles, johnny cakes, and all kinds of quick bread; Saturday, desserts of every description. The rules require that something about the use of corn must be taught at each lesson. Around the hall are arranged different articles regarded as desirable for household use, including novel forms of cook stoves, heaters, etc.

Mrs. Rorer has also a training class of girls between 12 and 16 years of age. It is limited to twenty pupils, and is free, five days a week, for one month; after which another class takes its place. Any girls may apply, regardless of family influence, race, color, or condition; the first applicants that come being taken. During the month they have passes admitting them to the Fair grounds. While in the general lectures Mrs. Rorer and her assistants do the cooking in the presence of the audience, the girls in the training classes have to do all the work themselves under the direction of the instructor. Though dealing mainly with methods, much valuable information is given concerning muscle food, brain food, hygiene, domestic economy, and the proper management of the home.

Where did Oxygen Come From?

It has often troubled philosophers to tell whether there is oxygen on the sun or not, but the late Mr. Proctor was of opinion that there is. Perhaps he was right; but on the strictly evolutionary basis, if Dr. T. L. Phipson is to be believed, he is wrong. Investigating the matter from the biological point of view, he observed that micro-organisms "manufactured oxygen," although they were not supplied with it. He also grew plants in an atmosphere of pure carbonic acid gas or a mixture of that and nitrogen, or in pure nitrogen alone with a root feed containing CO_2, he found that oxygen was gradually "manufactured." There is nothing very startling in that; in fact, it is entirely according to the Chemical Hoyle and biological precedent; but Dr. Phipson takes us back to the primitive ages of the globe, when there was no free oxygen upon it—because, he explains, there are now in the earth's crust matters which are oxidizable, and would have been oxidized during these far-back ages if there had been free oxygen to do it. So we arrive at the conclusion that there was at one time an oxygenless atmosphere. Where did the oxygen come from? Dr. Phipson replies that the oxygen of the atmosphere is the product of vegetable life, and "into the primitive atmosphere of nitrogen plants have poured oxygen, year after year, for countless myriads of ages, until it has attained the composition which it has at the present day."

Transparent Leather.

According to the *Magasin Pittoresque*, transparent leather may be manufactured as follows:

After the hair has been removed from the hide, the latter, tightly stretched upon a frame, is rubbed with the following mixture:

Glycerine (26° B.)	1,000 parts
Salicylic acid	2 "
Picric acid	2 "
Boric acid	25 "

Before the hide is absolutely dry, it is placed in a room which the rays of the sun do not penetrate, and is saturated with a solution of bichromate of potash. When the hide is very dry, there is applied to its surface an alcoholic solution of tortoise shell, and a transparent aspect is thus obtained.

This leather is exceedingly flexible. It is used for the manufacture of toilet articles, but there is nothing to prevent it from being used for foot gear, and, perhaps with fancy stockings, shoes made of it would not prove unpleasing to the sight. They would at least have the advantage of originality.

Correspondence.

Cure for Snake Bite.

To the Editor of the Scientific American:

From time to time I see in the papers recipes for curing the bites of poisonous snakes, recommended by medical and other people. In California, where I come from, we have occasion at times to treat animals for the bite of the deadly rattlesnake. I have seen two kinds of herbs used, one is called in Spanish "la golondrina" (the swallow), growing in the most arid plains; the other is the rattlesnake weed. Both are very effective, but it is not every one who can tell them, even when at hand. What I know from my own experience to be an infallible cure is the gall of the snake itself. One drop of it on the wound will effect a cure, even when inflammation is far advanced. I have seen a dog treated whose head had already swollen to twice its natural size, and it cured him almost instantaneously. The gall may be preserved in alcohol, or even dried, requiring in the latter case only to be moistened; even saliva alone between two stones will do. (I have seen a case of this kind.) If preserved in alcohol, of course, the whole bag of the gall is put into the liquid entire. If true of the rattlesnake, and, as I said before, I know it is infallible from my own experience, it is probably true of all other poisonous snakes, and might it not be true in the case of the rabies, that the gall of the animal would cure the bite?

When at college, in London, the teacher in French, who had been a Spahis in Algiers, assured me that the Arabs cured the sting of the scorpion by mashing the scorpion and applying it as a poultice on the wound. This I have never seen tried, however.

Mexico, Sept. 8, 1893. E. F. DE CELIS.

Increasing the Temperature of Steam.

Some short time ago, it was suggested by Lord Rayleigh that the efficiency of the steam engine might conceivably be increased by adding some salt to the water in the boiler, which should have the effect of raising the boiling point of the solution. The idea sought to be conveyed was that the initial temperature of the working fluid might be thereby increased; thus providing for a larger range and a greater fall of temperature between the boiler and the condenser.

Certain critics objected to this proposition that to raise the boiling point of an aqueous solution does not necessarily imply a corresponding elevation of the temperature of the evolved vapor, which is simply that of water, and must accordingly possess only the temperature corresponding to the pressure. A number of experiments to determine the temperature of the steam arising from a boiling salt solution have been made from time to time; but the results have been of a conflicting character. The difficulty of arriving at trustworthy results in this class of experiments consists in the circumstance that, while the walls of the steam chamber must be at a temperature higher than that of boiling water, and yet below the temperature of the solution, a sufficient quantity of steam must be evolved to insure that these walls shall not exercise any appreciable cooling effect upon it. These *desiderata* are claimed to be all satisfied by an arrangement devised by Professor Sakurai, of the College of Science of the Imperial Japanese University, by the aid of which it has been determined that the temperature of the steam escaping from boiling aqueous solutions of such salts as calcium chloride, sodium nitrate, and potassium nitrate is exactly the same as that of the solution itself. This is a corroboration of Lord Rayleigh; but, whether the fact is of any material service to mechanical engineers remains to be seen.

The New Morgan Liner El Cid.

The new freight steamship of the Morgan line El Cid has just completed her maiden voyage between New Orleans and New York, breaking all maiden records, her time being 4 days 2 hours and 15 minutes from bar to bar. Her average speed was 16¾ knots per hour, and her greatest run in one day 450 miles, which is certainly very creditable for an American-built coastwise steamer. El Cid was built by the Newport News Shipbuilding Company, of Newport News, Va. She is 406 feet long, beam 48 feet, and registers 4,500 tons. Triple expansion engines drive the 18 foot four-bladed propeller, the shaft measuring 16 inches in diameter. The boilers are three double-ended Scotch boilers, 26 feet 6 inches in length by 13 feet 10 inches in diameter. The vessel is lighted by 112 incandescent lamps. The pilot house is fitted up in a luxurious manner.

THE Weed boiler, which was described in our issue of Sept. 23, is made in such small sizes—⅛, ½, and 1 horse power—as to render it admirably suited for a great deal of amateur work. That it is so employed to a large extent is probably a leading consideration of its makers, Messrs. A. J. Weed & Co., of 106 and 108 Liberty Street, New York, in making safety and durability the first consideration in its construction.

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A WIRE ROPE TRAMWAY OPERATED AT THE FAIR.

Visitors at the World's Columbian Exposition who pass near the southwestern corner of the Mining building instinctively stop a few minutes to watch the succession of buckets that pass up and down two overhead wires stretched from a raised platform near the corner of this building to a spot near the Sixty-fourth Street entrance to the Exposition grounds. These buckets come and go with the persistent regularity of clockwork, and what adds interest to their passing is the fact that early in the day they transfer diamondiferous ground from the store yard at the distant terminal to the Mining building, whence it is transferred to the crushers which operate daily in the South African diamond exhibit in this building.

This conveyor, or, as it is more properly termed, wire rope tramway, forms part of the exhibit in the Mining department and was installed by the Trenton Iron Company, Trenton, N. J., to exploit its latest improved device for transporting ores in mining operations and for similar uses. It is what is called the "Bleichert" system of wire rope tramway. A peculiarity of this particular plant is that it works backward, that is, most of the actual work it does consists in carrying ore from outside into the level under the Mining building, instead of bringing ore out, as would ordinarily be the case. Nevertheless, its working powers are fully demonstrated.

The accompanying illustration represents the tramway as seen from the receiving end in the ore yard before referred to. From this yard the line runs alongside the tracks of the railway terminal station yard, then passes over the Intramural Railway at a sufficient height to escape any possible danger from passing trains, and terminates at the raised platform at the Mining building, giving a total length of about 1,000 feet. The supports of this tramway could, if desired, be made of wood, but iron ones of the type shown in the illustration are preferable for many reasons, and these supports vary in height according to the profile of the ground passed over and to the surface traffic. Most of the supports in this plant are from 15 to 20 feet high, but at the Intramural Railway they are nearly twice this height, in order to pass above it a sufficient distance. Two stationary cables are used for the buckets or cars to run on. These cables are stretched taut from support to support and they vary in size, according to the weight of loads to be carried and to the length of spans. Under ordinary circumstances supports are from 150 to 200 feet apart, but where the country is very irregular and bisected by ravines and gulches, as is frequently the case in mining regions, the spans become at times very long, in some cases reaching 1,000 and even 1,500 feet; and where loaded cars pass down on one cable and return on the other empty, the return cable can be considerably smaller in size than the other, as it is put to much less strain, thus saving materially in the cost of construction. Such cables as are used for this purpose stretch about one inch in one hundred feet, but this stretching is readily overcome by the use of tension devices at each end, and in lines that are several miles long by having tension stations at necessary intervals.

The buckets or cars or whatever form of carriages are used are suspended from the stationary cable by a truck which runs on this cable as on a rail. Below this cable is a second and smaller one which is called the traction cable and which transmits motion to the buckets. In this World's Fair plant electricity furnishes the motive power. Gearing on the motor shaft works in a worm wheel and reduces the speed to the desired point. At each end of the tramway is a large sheave around which the traction cable passes, and this sheave is so arranged that the tension of the cable can readily be regulated. Whenever it is desired to attach a bucket to this cable, a patent grip lug designed for this special purpose is attached to the cable and this lug is grasped by a simple locking device on the bucket support. Another lug is placed on the cable about one hundred feet ahead, the purpose of this being to automatically ring a bell as it reaches the loading or discharging point and to notify the man in charge that the bucket is just behind.

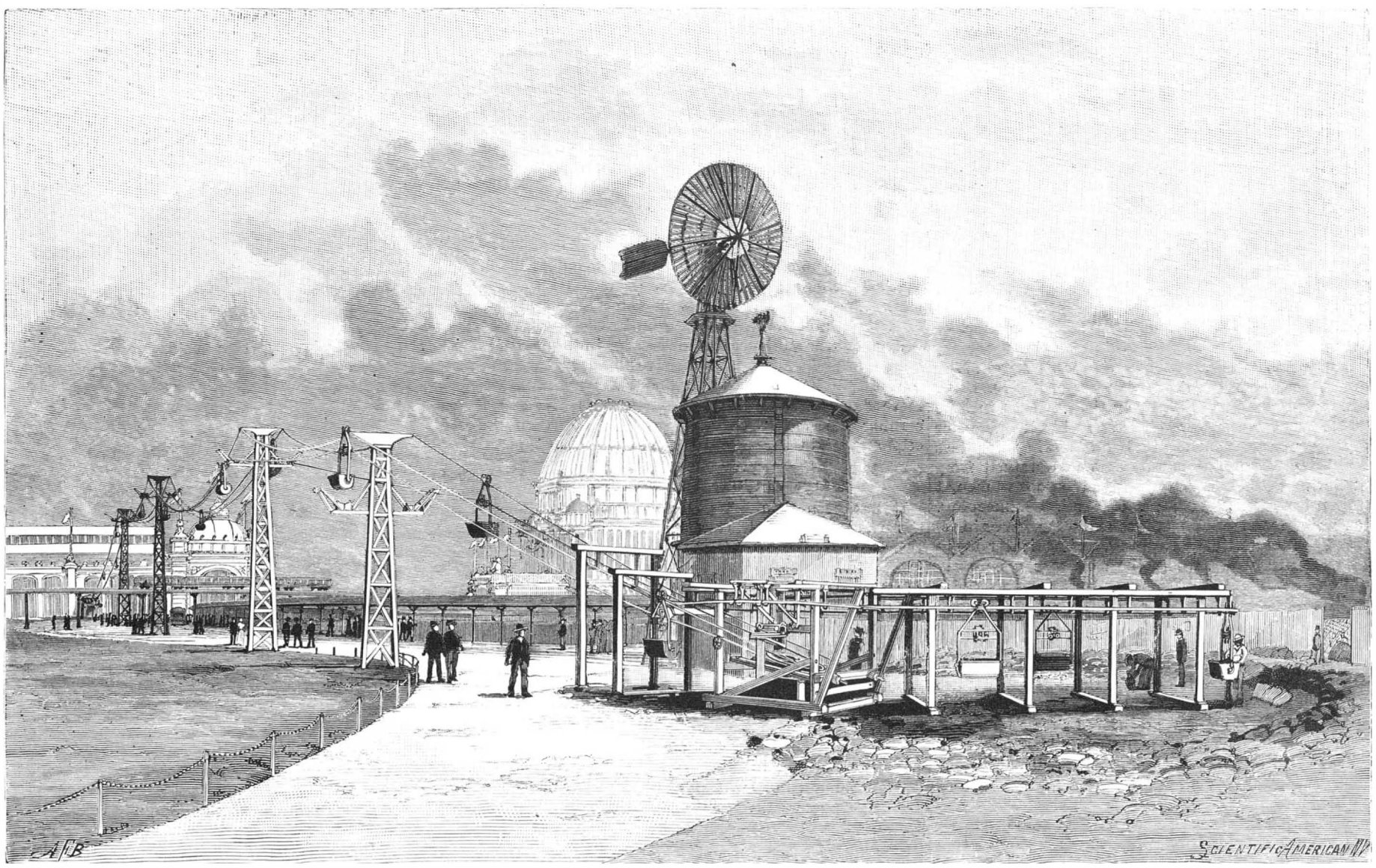
The illustration represents a bucket on the stationary cable at the right hand and approaching the terminal. As this bucket passes down the incline the lug ahead rings the bell and it follows behind until it approaches the station. In order to load and unload, it is most desirable that the bucket should be in a convenient location and at the proper height from the ground. In order to accomplish this a hanging rail is used. This rail is in close proximity to the stationary cable, and the car is automatically switched from the cable upon it by means of a simple device which unlocks the grip the bucket support has on the grip lug on the cable. The momentum that the car has obtained carries it some distance on this suspended rail. At the right of the terminal, as illustrated, is a framework which forms the loading or unloading station, as the case may be. By means of a switch the buckets can be switched off upon the suspended rail of this framework and there their load can be dumped into a chute or car as the case may be, or on the other hand they can run under a chute or otherwise be loaded, then switched from this suspended rail onto a corresponding rail on the terminal framework, where each bucket automatically grips the proper lug on the tension cable and starts off again on its journey. It is frequently necessary to know the amount of load that is carried, and for this purpose there is a device operated automatically by which each bucket load weighs itself and records its passing, so that the number of loads and weight of each load can be known.

The other terminal is constructed the same as this one and is provided with all necessary conveniences for loading and unloading the buckets, switching them to whichever track is desired and forwarding them again on their journey without undue delay, the only difference in this plant being that power is applied at this end in the World's Fair plant. When there is little or no delay in handling the buckets at either end, they simply run around a track suspended on the terminal framework and are started on their return journey by the attendant in charge. The buckets are attached so firmly to the tension cable by means of the grip lugs that the tramway can run up or down the steepest declivity without risk of upsetting. On some lines that have been built so much momentum is secured by the cars running down the line that sufficient power is obtained to return the buckets, so that only a nominal amount of power, if any, is needed to operate the tramway.

It has been found in ordinary use that the most economic speed to run this tramway is from three to four miles an hour, and when an increase of traffic is desired it is obtained to better advantage by increasing the number of buckets than by increasing the speed of the cable much above this rate. The heavy work falls almost entirely upon the stationary cable, and the traction cable is in a measure relieved from carrying its own weight, as it is suspended at intervals from the stationary cable, so that much heavier loads can be transported on a traction cable tramway of this kind than on a single cable tramway where the cable has also to support the load and carry the necessary dead weight in addition to propelling the cars and their loads.

These tramways have been introduced for such purposes as carrying ore, coal, lumber, cotton, phosphate and other commodities for considerable distances, when it is desired to reduce to a minimum the cost of handling. The tramway constructed on this system for the Granite Mining Company at Rumsey, Montana, is 8,750 feet long. It has a fall of 1,297 feet and develops on this fall over 14 horse power. On one span of this line there is a fall of 850 feet in 1,800 feet or about one to two. A tramway built for a mining company in the Andes Mountains, in Peru, South America, was carried to its location in small pieces, no one of which weighed over 300 pounds, as it was transported on the backs of mules. This line is two miles long and has a fall of 4,920 feet, developing more than sufficient power necessary to carry back to the mines all freight, including water and other supplies.

At the time this tramway was constructed, it was planned to have a complete mining plant in the ground under the Mining building, with mining machinery in



THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE TRENTON IRON WORKS.

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operation, and other mining equipment shown as in actual service. This plan however, was not carried out, chiefly from the fact that the water line is only two and three feet below the surface of the ground. There is, however, a level extending from immediately underneath the east terminal of this tramway under the Mining building to the southeast corner, and in this is installed a railway, the cars of which are operated by a tail rope by means of a steam tail rope engine. In addition to this tramway and the equipment in the mining level, the Trenton Iron Company has an exhibit in the Transportation building which should be seen and carefully studied in connection with them, as wire cables of various kinds, especially this company's locked wire ropes and heavy traction cables, are exhibited together with mining cars and other manufactures of iron and steel. This company also manufactures a single track tramway, constructed under the Bleichert patents, which is less expensive to construct, but about the same in the cost of maintenance and which has considerable less carrying capacity than the two-wire system just described.

Freaks of Lightning.

During a recent thunderstorm a singular freak of lightning was noticed in the vineyard of Mount St. Mary's College, near Emmitsburg, Md. The lightning first struck a tree and killed it; the apples at present hanging on the tree withered. It then passed to the roots of the tree and tore up the ground, as if it had been plowed for a distance of about twenty feet. It then struck the end post of a grape arbor, knocking a large piece of the post that supported the vines a distance of forty feet. It then ran along the lower wire that supports the vines, about two hundred feet, to the opposite end of the grape arbor, where it pulled out the staple which was attached to the post, knocking a piece out of that post also. On the way, the grapes that hung near the wire were injured, so that they withered on the stem. The grapes that hung higher up were less damaged. The same effect, in a less degree, was produced on two adjacent arbors running parallel to the one just mentioned, one on each side of it, at a distance about thirty feet.

The Charleston Harbor Improvements.

The improvements in the harbor of Charleston, S. C., are beginning to show a marked increase in the depth of water in the channel, says the *Southern States*. Important progress has been made in the work on the jetties, and in the Swash Channel on July 7 the depth of water at low tide at the entrance was 15·9 feet, and at the inner shallow spot 15·7 feet. Add to this five feet of water, caused by the rise of tide, and it figures up 20·9 at one point and 20·7 at the other. With a strong east wind, which is often blowing on the bar, the tide rises at least a foot higher, making the water 21·9 feet and 21·7 feet, respectively. The dredges are working at the mouth of the channel and are excavating 2,000 cubic yards of sand daily.

LIGHT LOCOMOTIVES SHOWN AT THE FAIR.

This interesting exhibit includes five locomotives, four of them in the Transportation department, and one logging locomotive shown in connection with the Michigan logging exhibit. The engines shown do not by any means cover all the specialties made by the firm, which include compressed air locomotives for mines and for street railways, steam locomotives for underground use, several varieties of suburban locomotives, plantation locomotives of different types, steel and furnace work locomotives for service close to converters, coke oven locomotives, shifting locomotives, etc.

The five locomotives shown are of the regular commercial grade made by the firm, and are adapted for severe service and hard usage, where the tracks are often rough and badly laid, with grades and curves excessive, and where the work is frequently carried on continuously by different shifts of men. This has necessitated the use of the best materials, the making of parts strong, without clumsiness, and the utmost simplicity of construction. Among characteristic items differing from common practice are the following:

1. Hanging cross heads of steel, specially designed for replacing gibs, and lining up by removal of plate only.

2. Specially constructed spring piston rings, sprung into grooves, and piston head solid, except lightening core, with rod riveted in, so that no bolts or nuts can come loose, need adjustment, or break; the rings are first rough-turned, then a piece removed, then clamped and turned to true circle, causing them to press out equally, giving wearing surface always conformed to cylinder.

3. The links are skeleton style of casehardened mild steel, and will outlast objectionably heavy links. Lost motion can be taken up easily, and casehardened steel pins and thimbles are removable throughout, even the link saddle bearings being fitted with thimbles.

4. Tires are bored taper, and pressed on tapered centers, and can be taken off and renewed without a wheel press, and cannot come loose.

5. Driving box brasses (unless otherwise desired) are in sections, and can be put in place without a press.

6. All wearing brasses are made of ingot copper and tin, as hard as can be made, no scrap being used.

7. Cylinders and driving wheels are made of specially selected close and hard charcoal mixture of metal, no scrap being used.

8. For the smaller engines extra strong frames and bumper attachments are necessary, as these locomotives are used very roughly, especially in steel works and similar service, where solid heavy cast iron cars are used; it is also desirable to have these engines as narrow as practicable, as side room is usually limited. These conflicting requirements are met by flattening and deepening the frames at each end, securing extreme strength in the direction of heaviest strains. The bumper angle irons are extra heavy and well secured, and when desirable the bumpers are backed up by a cast tool-pocket between the frames, combining convenience with the strongest possible bracing, and not in the way, like the ordinary front braces bolted to the smoke box.

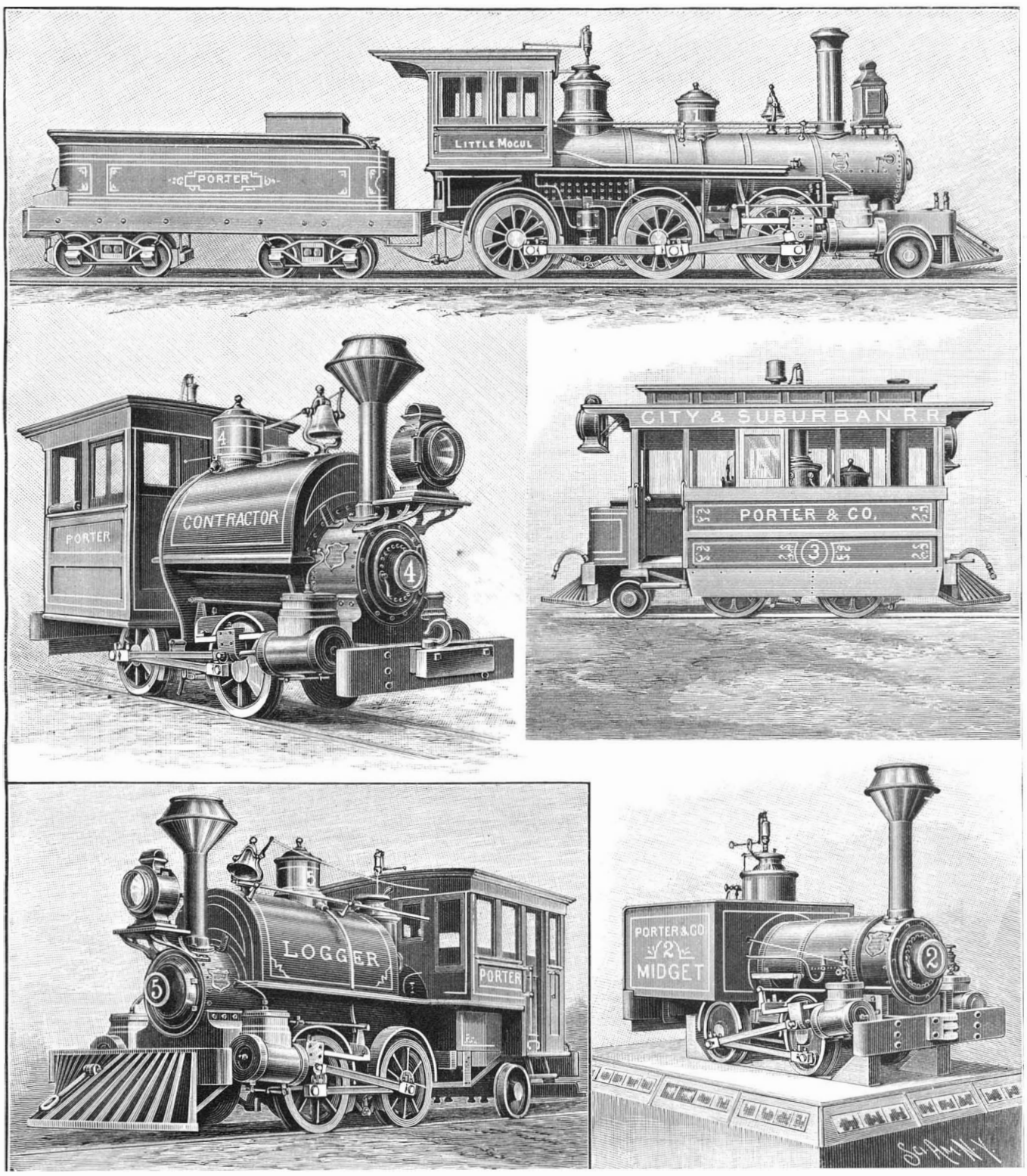
9. Pony trucks are a special design, adding a rolling motion to the radial, pivotal, and swing motions of the Bissell type of truck, so that curves otherwise impracticable are easily passed.

10. Fireboxes are made with sides and crown of one piece, avoiding two riveted seams, making a stronger firebox and diminishing formation of scale.

11. Rivets are hand riveted by special process, making both heads alike and equally strong.

The special points of excellence claimed for the Little Mogul, shown at the top of the picture, include adaptability of design to railroads of light character, admitting rails of 35 and 40 pounds per yard, and curves 15 to 30 degrees. Such roads are used for logging where the distance and the traffic are considerable, for mining districts, and for local purposes of all kinds, and can be operated at a good profit while developing new countries, where heavily equipped roads would not begin to pay for years. Its construction is marked by simplicity of details and general arrangement, and freedom from complications. Strength and durability are secured by intelligent use of materials, and its practical efficiency is secured by a large firebox and abundantly large boiler. The valve motion is planned for quickness and promptness, and adapted for passenger service at high speed, as well as for freight service at slower speed. Flexibility is secured by a complete system of equalizing, and by special design of truck, in combination with advantageous distribution of weight, combining power with ease on the rail, and easy curving and steady motion.

The "Midget" is of a style used by various manufacturing establishments, such as steel and iron mills, where small car loads of material are to be carried everywhere throughout the works with quickness and ease. It does the work of ten to thirty animals. As



THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF H. K. PORTER & CO., OF PITTSBURG, PA.

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shown in the Exposition, this engine is blocked up on a platform and run by compressed air. The utmost power is secured by small driving wheels, with a correspondingly sufficient weight, all carried on the driving wheels. Sharp corners are easily turned, as the wheel base is short, sometimes but a little over 24 inches, in engines of this class. The engineer has an unobstructed view in all directions, which is desirable for safety when running through buildings and yards. All valves, levers, gauges, etc., are in easy reach. The cylinders are inclined sufficiently to avoid obstructions on the floor, and also to keep the machinery out of the dust. The links are also at a good height from the floor. The proportions of the boiler are such that only an occasional lump of coal is needed under usual conditions. This general type is built as narrow as 18 inches and 20 inches gauge, and one regular size still smaller, with 5 by 10 cylinders. This locomotive differs from the other four of the exhibit in having solid chilled driving wheels instead of wheels with steel tires.

The "City and Suburban" railroad locomotive is especially designed for light traffic where speed is needed, affording sufficient power, allowing the use of light rails and adapted to turn sharp curves in crowded city streets. Power is secured by as much weight on the drivers as is desirable for the proportions of cylinders to the driving wheels used, and ease of motion is secured by the equalizing of the driving wheels and the use of the rear truck. The special truck enables the motor to pass with ease curves that would be otherwise impracticable. The boiler is of abundant capacity and adapted to anthracite coal or coke. The noise of the ordinary exhaust is avoided by a simple design of exhaust which converts the usual intermittent noisy action into a quiet, continuous flow. Motors of this class are designed to make money where the distance is too long and the business too light to justify the extra cost of any other system, while when traffic is heavy, as on special occasions, they can be used to handle the greatest number of passengers at least expense.

The "Contractor" is designed for a wide range of special service, such as contractors' work, government improvements, coal and ore roads, quarries, iron, copper, fire clay and phosphate mines, industrial roads, etc. Tracks for these purposes are usually short, but with very bad curves and steep grades, and the work is continuous and severe. Power is secured by putting all the weight on the drivers and using small drivers. The wheelbase is short, so that the engine can pass excessive curves easily, but also long enough, compared with total length of engine, to avoid, to a great extent, the rocking and plunging motion common to four-wheel machines. The machinery throughout is designed so that repairs, whether due to accident or wear, can be made by an ordinary locomotive engineer without shop or special tools quickly and cheaply.

The "Logger" has special adaptations for running on logging railroads and similar service. These roads usually vary from 1 to 2 miles to 8 to 12 miles in length, and are laid with light steel rails, 16 to 30 lb. per yard, or sometimes with wooden rails. Power is secured by carrying the greater part of the weight on the driving wheels. These engines are designed for their size of cylinders, with a given length of haul and weight of rail, and grades and curves to get out a greater amount of logs per day, and be depended on to keep up their daily output for months at a time, without interruption, at less cost to operate than other engines.

We also present an illustration of a compressed air mine locomotive made by this firm, but not shown at the Exposition, these locomotives being especially desirable where the ventilation is bad. This locomotive may have one, two or three tanks for compressed air, to be charged up to 400 to 700 pounds pressure, and may be 4, 5 or 6 feet high, according to the height of the mine entry and passages. These locomotives are built of different capacities, to haul from 150 to 600 tons on a level.

The firm make and keep in stock duplicate parts for all standard sizes and designs of their machines, so that on receipt of a telegram the required piece is immediately shipped, which has come to be a necessity from the fact that their business, commercially as well as mechanically, is widely different from usual locomotive work. Their trade is largely in single engines, of all possible gauges of track, for all kinds of usage, of greatly varying sizes and designs, and requiring special modifications to secure best results in each separate case. Their output has increased constantly, and they have built over 1,500 of these light locomotives for use in the various States and Territories of the United States, including Alaska; and for export to Canada, Mexico, Cuba and the West Indies, Yucatan, Panama, Colombia, Venezuela, Guiana, Brazil, Argentine Republic, Uruguay, Peru, Chile, Equador, Hawaiian Islands and Japan. Their export trade amounts to about 15 per cent of their production.

The office of the company is at No. 543 Wood Street, Pittsburg, Pa. A large illustrated catalogue will be sent, on application, to interested parties.

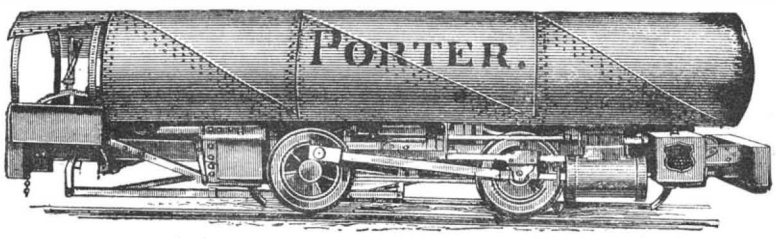
MOUNTING OF LARGE ANIMALS.

BY L. L. DYCHE.

The system shown in the accompanying views is called the statue method, from the fact that a statue is built to represent the body of the animal and over this completed statue or body form the skin is fitted. The most natural place with which to begin our description is the animal itself. A good prime skin from a good animal is the first requisite for good work. The individual animal intended to be mounted for a specimen should be well studied before and after skinning when this is possible. If this cannot be done, then some other animal of the species must be thoroughly studied.

Before placing the skin on the completed statue, it should be thoroughly tanned. In order that this may be accomplished, all fat and flesh should be carefully removed from it. It should also be shaved down, if thick like that of a moose or buffalo skin, to an even thickness all over. A draw shave and sharp knives can be used, but the regular fleshing knives used by tanners have been productive of the best results in my laboratory, especially with large skins.

The operator must know his animal before he can hope to produce its form in the shape of a statue. In order to facilitate his work he should have at hand a complete series of notes and measurements, giving all diameters, circumferences and anatomical characteristics of the animal. Drawings, sketches and photographs of dead and live animals are always of great value. Aside from all this, the operator should know his animal in another way. He should know it so well that he could produce a good sketch or small clay model of it from memory. Again he should know it so well that he could deduce all the essential measurements from a single bone, especially a leg bone. No difference what the circumstances are, he must know his animal and know it well before he can hope for any success in the mounting of it.



PORTER COMPRESSED AIR LOCOMOTIVE.

With the anatomy of the animal well in hand, looked at both from a scientific and artistic standpoint, the operator is now ready for the next step, which is to put up the so-called framework or core of the statue. This will be seen to best advantage by carefully examining the mechanism of Fig. 1. The midrib or body board, as it is usually called (on which the word Comanche is written in Fig. 1), is placed in the center as a backbone of strength, and roughly represents a vertical and longitudinal section through the body. This board extends from the base of the neck to the back part of the pelvis. A board about two inches thick is used in an animal the size of a horse. To the sides of it are fastened, in their proper places, L-shaped pieces, called in the language of the laboratory "angle irons" (see B, in Fig. 1). One end of the L-shaped piece or "angle iron" (made in this case from strap iron two inches wide and three-eighths thick) is bolted to the body board. The other end, which extends some five inches at right angles from the body board, has been twisted half way round and has a hole near the end large enough to receive the upper end of the leg iron. This latter has a thread cut on it which allows it to be securely fastened by nuts, one above and the other below the arm of the angle iron. The leg irons are bent to proper shape and the leg bones are fastened securely to them by means of stout cord and wire. This work should be done before the leg irons are fastened to the body board. In case the leg bones were not saved or have been lost, wooden ones are either carved to take their place or the statue is developed without them.

The skull is now properly adjusted upon stout rods, and the pelvis and shoulder blades, when the latter are used, are put in place. Perpendicular side strips are fastened to the body board, and to these laths are nailed. This not only makes the body hollow, and consequently lighter, but gives size to the body, and saves winding on so much wood fiber or excelsior. Upon the proper adjustment of the framework depends the success of the mount. This framework is one of the most difficult things the operator has to contend with. In no business can it be more truthfully said that "well begun is half done." Not only the legs, with all their bends and curves, but the height, length and width of the animal's body, must be determined at this early stage of development; in fact, the operator must see in this roughly constructed form his animal all completed and finished as a perfect specimen. A knowledge of comparative osteology is almost indispensable at this stage of the work.

The framework completed and corrected for every possible error, and the position or attitude of the animal determined, the next step is to begin the development of the statue proper. This is done by winding and sewing on wood fiber or excelsior. It takes time to become even a good mechanical winder. The excelsior should be wound on with an even compactness. The statue finished in wood fiber should be solid, and yet spring when the hand is pressed against it. There should be no soft places. With a year's practice men in my laboratory usually become very good mechanical winders. Figs. 2 and 3 represent the statue in process of construction. Fig. 4 represents the statue as finished by winding and sewing on excelsior, and should in a rough way represent the surface contour of the body of the skinned horse. This rough statue is now finished in modeling clay much after the fashion that a sculptor finishes a statue. The first coat of clay is, however, put on in a thin pasty condition and rubbed into the excelsior. Without anatomical knowledge and skill the operator cannot hope for much success either with the rough statue or the finished clay model. Fig. 5 represents the statue all finished in clay ready for the skin. The skin has been kept in tan liquor for at least six months, and is thoroughly flexible and soft. Fig. 6 shows the process of putting the skin on the complete statue of the horse Comanche. The skin is sewed up, commencing at the feet. Two needles are used, and the stitch might be called the double baseball.

As each leg is sewed up, care must be taken that clay is filled in wherever necessary to bring out each anatomical development. The work of sewing is finally completed, but the horse is still a sorrowful looking specimen. While the clay is yet soft the small anatomical details characteristic of the animal must be carefully worked out. The feet, joints, flanks, shoulders, ears, muzzle and eyes take days and sometimes weeks of painstaking labor to give them that delicate touch of ease and grace seen in the living, breathing animal. Too much pains cannot be taken with the head. It is frequently kept wrapped in damp blankets for two or three months, while the minute anatomy of the nose and eyes are being worked out in fine detail. A year sometimes passes before the eye gets its final finishing touches.

He Could Break the Crystal.

As a variation on the time-honored story regarding the perfection of control attainable with steam hammers, London *Tit Bits* gets off the following:

"I have been told," said Mr. Dubois, watching the great steam hammer in the rolling mill, "that a good hammerman can break the crystal of a watch with that 30 ton hammer."

"Yes, sir," said the hammerman, "it can be done."

"I should like to see it," said Mr. Dubois eagerly, feeling in his watch pocket.

"I can do it, sir," replied the man.

"And will you?" replied Mr. Dubois, drawing out his watch. "Come, I am anxious to see it tried."

He laid his watch on the great anvil plate. The hammer rose to its full height, and the next instant all its ponderous weight, with a crushing force which shook the ground for an acre round, came down on the watch.

"There, sir," said the hammerman, "if you don't believe that crystal is broken, just step down and you can see it sticking to the hammer."

Mr. Dubois swallowed a whole mouthful of lumps and gasped before he could speak.

"But I forgot to say," he exclaimed, "that it was to break the crystal without injuring the watch."

"Oh, yes," said the hammerman—"Yes, I know. I have heard that rubbish myself, but it's all gammon. I don't believe it. But you can break the crystal any time."

THE Chesapeake & Ohio Railroad Company have just inaugurated the Chesapeake & Ohio Steamship line, which will run between Newport News, Va., to Liverpool and London. Six new steamers have been built at West Hartlepool and Glasgow. Each boat will make the round trip in about six weeks. All of them will be devoted to freight traffic exclusively. Newport News is near the Mississippi, and considerable grain from the Northwest can be diverted from the northeastern lines to the C. & O. The harbor of Hampton Roads is superb, and the terminal facilities of the railroad at Newport News are excellent, its grain elevator stores 1,600,000 bushels, and its yard has room for 3,000 cars. There are seven great piers, the capacity of the export merchandise pier being 1,500 cars. The new vessel which was present at the inauguration was the Rappahannock, 370 feet long, 44 feet beam, with a gross tonnage of 3,860 tons; top speed, 14 knots.

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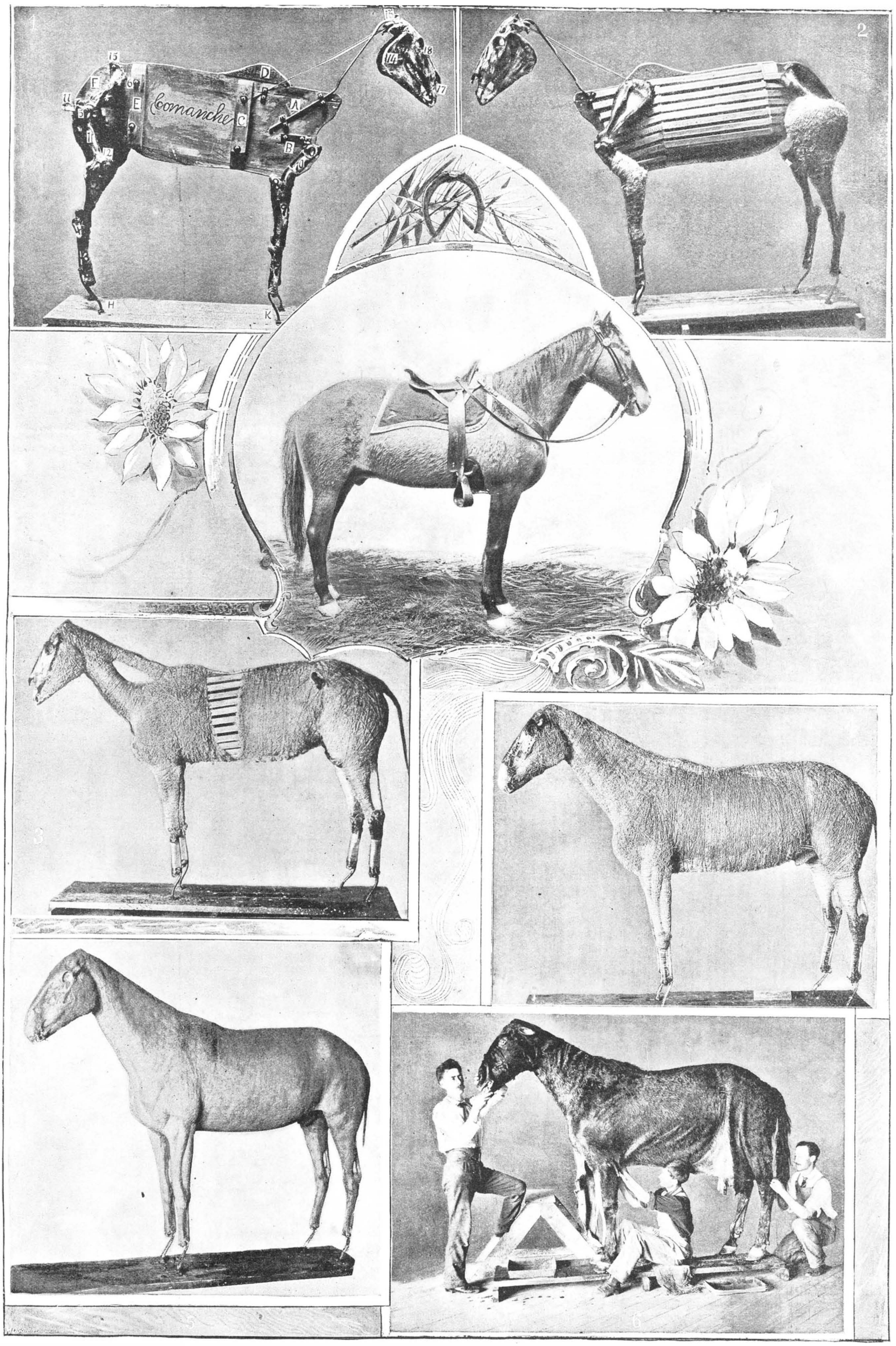

1. First framework of statue or body form. 2 and 3. Successive stages of development. 4. Statue finished by winding and sewing on excelsior. 5. Statue finished in clay, ready for the skin. **6.** Process of putting on the skin.

THE WORLD'S COLUMBIAN EXPOSITION—EXHIBITS OF MOUNTED ANIMALS.

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RECENTLY PATENTED INVENTIONS.

Engineering.

ENGINE GOVERNOR.—Robert H. Thurston, Ithaca, N. Y. This is a centrifugal governor of very simple and durable construction, to uniformly and accurately govern the speed of the engine according to the load. It consists of a single flexible arm secured at one end to a wheel or arm on the main driving shaft of the engine and carrying at its free end a weight, this arm being directly connected with the valve gear of the engine at a point in a circle passing through the center of the wheel, the center of the circle being the fastening point of the arm on the wheel.

GRAVITY PUMP.—William A. Hartt, Tucson, Arizona Ter. This improvement comprises two sets of cylinders, each set containing two cylinders of different diameters, one set being located beyond the other, and connected pistons of different diameters traveling in each set of cylinders, while pipes of varying diameters and length connect the two sets of cylinders with each other. This pump operates automatically, and is more especially designed for raising water, etc., out of mines and reservoirs, and discharging at a lower point.

Railway Appliances.

CAR COUPLING.—Samuel A. Yeager and Wilson I. Luckenbach, Bethlehem, Pa., and Alfred P. Balliet, Coplay, Pa. This coupler is of the knuckle type, but provides for coupling in the ordinary way with an opposing knuckle drawhead, and also for quickly shifting the knuckle to convert the coupler into one of the Miller type, in which a spring-controlled hook is located near the center of the drawhead, a spring in the drawhead adapting the coupler for the latter use, but not interfering with it as a knuckle coupler. The construction is very strong, and the pivot pin and knuckle may be readily shifted to one side or to the central portion of the drawhead, while the locking pin may be readily manipulated from the sides or the top of the car.

TRACK JACK.—Joseph McMurrin, Shoshone, Idaho. According to this invention a ratchet slide moves upon a standard toothed on opposite sides, the ratched carrying spring-controlled dogs engaging the teeth, and the slide and the dogs having registering openings for the reception of a railroad pick or like tool. The device is very strong and of simple construction, and is especially adapted for lifting rails, being readily movable from place to place and operated by one person with no other lever than a railroad pick or similar tool.

Mechanical.

BENCH DOG.—Charles L. Bronk, New York City. This device comprises a bottom plate adapted to be screwed upon the bench and having raised ears between which freely slides a locking dog actuated by a cam lever, the latter having a curved slot near its forward end, a screw stud in which engages the locking dog, while a screw bolt is passed through a central longitudinal slot of the cam lever to engagement with a threaded perforation in the bottom plate. The device is inexpensive, and well adapted to conveniently lock upon the bench a board or other piece of wood to be planed.

WORK HOLDING CLAMP.—William J. Avey, Cincinnati, Ohio. This is a strong and readily adjustable device for application to and to hold the work in place upon wood-working machines where the knives work up through the table, and the wood is passed over them upon the table top. It comprises an edgewise-held spring plate, opposite and adjustable to and from which are clamping rollers, while yieldingly supported rollers engage the top of the work, and means are provided for adjusting both sets of rollers horizontally and vertically. The device may be quickly adjusted to different shapes, circular and straight, preventing the workman's hands from coming into contact with the cutters, and forming a convenient guide, when once adjusted to one piece, for other similar pieces.

SELF-TRIPPING PULLEY BLOCK.—Colin Matheson, Eureka, Cal. This block has an open side, a pulley being journaled above and another below the opening, the second pulley having a grooved face to receive the cable and projecting cogs at its outer edge. The improvement is designed for use in connection with cables for drawing logs, cars, etc., tripping the branch cables which carry the load directly in passing around curves, so that the cables may swing outward and facilitate a good turn, obviating the necessity of dragging the cables on the ground.

NUT LOCK.—Edward E. Poole, Fordyce, Ark. This device comprises a washer plate through which the bolt passes, and provided with two slits forming a tongue and pawl in the plate, both the pawl and tongue being bent forward at their free ends, and both pointing and facing in the same direction with respect to the revolution of the nut. The plate is slipped on the bolt in advance of the nut, and the latter turned up against it will turn on past the pawl and tongue, and when turned home will be held by these parts from jarring loose and coming off.

Agricultural.

THRASHING MACHINE ATTACHMENT.—Hermann A. Stoltenberg, Hollyrood, Kansas. This is a device especially adapted for feeding banded grain, and may be attached to a machine of any size or capacity. It has a series of reciprocating feed arms carrying knives, and a feed device consisting of a grating pivoted at one end and located over the arms, there being a rock shaft below the opposite end of the grating, the shaft and grating being pivotally connected by links, and a pawl and ratchet mechanism connected with the shaft. The bundles of grain thrown on the feed table are automatically carried forward, separated, their bands cut, and the grain and straw delivered to the machine in proper condition to be thrashed.

STALK CUTTER.—William M. Mueller and Oskar F. Burford, Elmwood, Neb. This is a machine adapted to be driven over a field where the stalks are left lying upon the ground, and cuts the stalks into such lengths as may be desired to enable them to be plowed under. The machine has a skeleton straightening frame from which are supported hooks which travel on the ground to straighten the stalks, after which they are pressed upon by a roller which holds them while they are cut by a vertically reciprocating knife at the rear of the machine, the lengths in which the stalks are cut being regulated by the length of the stroke of the cutting frame.

Miscellaneous.

COTTON BALING APPARATUS.—Edmund M. Ivens, New Orleans, La. This is an apparatus for baling lint or condensed cotton direct from the gin without tramping it in the press box, and packs the cotton in a seven foot instead of a twelve foot box, thus lightening the weight of the box and shortening the travel of the main screw presser platen. It has a swinging press box with two chambers, a junior presser follower mechanism giving the cotton an initial pressure in the receiving chamber, while a senior or cumulative pressure platen gives the second and final compression to the partially compressed bale after the box is swung to change the position of the chambers, the operations in both chambers going on simultaneously.

SAFETY JOINT FOR ELECTRIC CONDUCTORS.—James H. Curry, Wilkinsburg, Pa. This is an automatic joint consisting of an insulated containing case, through the ends of which pass conducting stems forced inwardly by springs, while sliding electrical contact surfaces are arranged upon the inner ends of the stems and adapted to break circuit by being moved inwardly past each other. Insulation is disposed of between the conducting stems and the contacts on the one hand and the containing case on the other to maintain a permanent insulation for the containing case in all positions of the parts. The outer casing is always insulated from the line currents, and is never a live surface, thus reducing danger to line men.

ORE SEPARATOR AND CONCENTRATOR.—Ira F. Monell, Sugar Loaf, Col. This is an improvement on a formerly patented invention of the same inventor, and provides an effective separator and concentrator of very simple and durable construction. It has improved means for conveniently adjusting the mechanism for bumping a depending swinging table beneath the belt upon which the ore is passed, whereby the concussion may be regulated according to the nature of the material being treated, too heavy a concussion sometimes shaking the mineral up into the current to be carried away with the sand.

FIRE EXTINGUISHER AND ALARM.—Edward Livingston, New Orleans, La. This is an automatically working apparatus, comprising a series of pipes arranged in the rooms of a building and filled with fire-extinguishing fluid of liquid, gaseous or compressed gaseous form, the pipes being connected with a supply tank and fitted with fusion valves adapted to open at a temperature of about 160° F. Connected with the system is a tank for generating a fire-extinguishing gas, the devices for generating the gas being under the control of the fluid contained in the pipes. The apparatus is also electrically connected with an alarm, located where desired, and arranged to give warning when one or more of the fusion valves are opened by heat.

SLEIGH.—Charles G. Regnstrom, Ishpeming, Mich. This is a sleigh especially for coasting purposes, of very light construction, with a seat having arms and firmly attached by rods and braces to the low runners. Back of the seat on each of the low runners is a foot rest, on which a person may stand with one or both feet, using one foot when desired to push or steer the sleigh, the seat being occupied by another. A handle bar connects the tops of the seat posts, to be taken hold of by one standing on the foot rests.

BRIDLE BIT.—Herman Zahl, Momence, Ill. Two separate and independent longitudinally slotted side links have transverse slots at their upper and lower ends, the upper slots being for the cheek straps while a chin strap is secured in the lower slots, the bit proper extending through the longitudinal slots and having rings at its ends. A simple and effective bridle attachment is thus formed for more readily restraining vicious horses.

HALTER HITCH.—Richard H. Bacot, St. Louis, Mo. This is an extremely simple attachment to enable the straps to be quickly secured without tying a knot, and so that they cannot be unfastened except by turning the free end of the strap into a peculiar position, thus guarding against accidental releasing. A link with projecting loop is secured to the free end of the strap, on which loosely slides a sleeve, having on one face a headed stud or button, adjacent to which is an undercut projection or tongue

SOLE AND HEEL PLATE.—John I. E. Nelson, Cedar Home, Washington. This is an improvement in footwear for lumbermen and others engaged in heavy work where the boots or shoes are frequently wet, rendering them more durable and keeping the soles to the desired stiffness and firmness. It consists of a metallic sole piece, with tread shank and heel seat, the treads having openings for spike shanks and a spike plate fitting in a heel mortise. The metallic bottoms are preferably of aluminum and steel, and the tread is formed with corrugations or ridges, the ribbed surface preventing slipping when the spikes are not needed.

LATCH.—John L. Dale, Whaleysville, Md. This latch comprises a spring rod or bar with an eye or handle at its outer end where it engages the catch, while its inner end is held in an elongated clip, a lateral bent portion or stud on the rod entering an opening or seat in the clip. The device is of very simple and inexpensive construction.

FOLDING STEP.—Henry J. Climer, Anna, Ill. A simple flight of steps, to be cheaply and conveniently attached to a vehicle, cars, etc., is provided by this improvement, the steps when not in use being collapsed or folded to occupy but little space and be entirely out of the way. The steps are suspended one beneath the other from a fixed step by means of flexible hangers, while a lever fulcrumed on the vehicle extends beneath the lower step, whereby the steps may be readily opened out or folded up.

WINDOW SHADE SUPPORTER.—Stephen T. Stuver, Puyallup, Washington. This is an improvement on a formerly patented invention of the same inventor for an adjustable device consisting of a sectional wire truss frame, the upper and lower wires sliding upon each other, and locking devices holding the sections at their adjustment. Suspension eyes insure the straight hanging of the shade, and the construction is such that all soldering of parts together is avoided. Provision is made to accommodate a spring roller shade or a curtain pole, forming a combined roller shade and curtain supporter.

WINDOW BEAD FASTENER.—Henry A. Green, Montrose, Col. A locking device for window strips is provided by this invention, comprising a bracket plate having ears, a clamping limb pivoted at one end between the ears, and a pivoted locking dog adapted to press on the pivoted end of the clamping limb. The improvement dispenses with the use of screws or nails in the bead strips of a window, affords a reliable lock which permits the quick release of the strips, and may be manufactured to be ornamental as well as useful.

SHUTTER FASTENER.—August F. Gustafson, New York City. A combined latch and catch is, according to this improvement, pivoted near the outer edge of the blind and operated by a pull rod or drawbar. The latch is spring-actuated, and is pivoted in a plate attached to the inner side of the blind, having a terminal catch or shoulder projecting outward from the blind hinge, while the drawbar has a rigid laterally projecting handle and is arranged in a recess in the blind, being also pivoted to the latch at a point between its pivotal point and catch.

SEAT.—George A. Ennis, Livingston, Montana. This is a simple and substantial seat suspended on springs in such a way as to be very easy and comfortable. It is especially adapted for use in a locomotive cab. It may be quickly and nicely adjusted for height, has an adjustable back which may be held at any desired angle to the seat bottom, and has an arm which may also be adjusted vertically to suit the occupant.

DISPLAY RACK.—Mathew R. Dickson, New York City. A post mounted on a suitable base has one or more square portions having transverse pivots on which turn keepers, the latter being each provided with a number of supporting arms, a spring catch locking the keeper in place to extend the arms horizontally. The device is readily foldable, and when the arms are extended it is well adapted for the display of neckties, hats, etc.

PENHOLDER.—James B. Geissinger, New York City. This is a thimble device, to hold on the end of the finger, and has hollow walls forming an annular ink reservoir, there being a threaded tubular extension on the closed end of the thimble which receives a screw plug having a slot to receive the pen, to which a conducting tube leads from the ink reservoir.

DENTAL MALLET.—John H. Demonet, Brooklyn, N. Y. This is a device having a central shaft to be connected with a source of rotary motion and power while the shell or handle of the instrument is grasped by an operator, in using it to consolidate fillings. It is a neat, simple, and portable device, adapted to strike a proper blow on a supported plugging tool by a rotatable movement of parts in either direction, and its action may at any time be instantly stopped when desired.

TICKET AND CHANGE POCKET.—Martin Ralph, New York City. This pocket is preferably made of cloth-lined paper, and has in one side perforations to permit of the inspection of a coin through them, while its back side is formed of overlapping flaps, constituting receptacles in which tickets may be carried. It is especially intended for use at railway ticket offices, where it is necessary to make change often, or it may be conveniently applied to a pocket, or pocketbook, card case, etc.

CAT BARRIER.—George S. Niles, Brooklyn, N. Y. This device consists essentially of a wheel, whose shaft runs lengthwise of and just above the top of the fence or wall. The wheel readily revolves when touched, so that the animal can obtain no purchase thereon, and cannot walk along it, in either effort being precipitated to the ground.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

HENDRICKS' ARCHITECTS' AND BUILDERS' GUIDE AND CONTRACTORS' DIRECTORY OF AMERICA. For the years 1893–94. New York: Samuel A. Hendricks Co. 1893. Pp. 647. Price $5. Index not paged.

This work under different countries, States, and the towns therein gives the names of a large number of classes of professional men and dealers in supplies connected with the building industry of the United States and Spanish America. Thus the book starts with a section of over 20 pages devoted to architects alone. Going further through the book, we find a section of about 150 pages devoted to carpenters and builders. In this way, under a great many titles, the addresses are given of representative houses in the many trades relating to contracting and building. It is a most useful work and among those interested it will meet with a welcome reception. An index gives the different titles of business under which the names are given and the work itself, arranged as it is alphabetically, is in some sense an index.

A PRACTICAL HAND BOOK OF MODERN PHOTOGRAPHY FOR THE USE OF AMATEURS. By Edward T. Bubier, Second. Bubier Publishing Company, Lynn, Mass. Pp. 65. Illustrated. 50 cents.

A compact, well printed little book containing useful hints and formulas for the practice of photography by amateurs, divided into four chapters.

RATHGEBER FUR ANFANGER IM PHOTOGRAPHIREN. By L. David. Halle a. S., Germany: Wilhelm Knapp. 65 cuts, 2 plates. Pp. 128.

This little book gives advice to amateurs in photography, is well illustrated, and written in popular style for any one to readily understand and comprehend the art of photography.

BULBS AND TUBEROUS-ROOTED PLANTS. Their history, description, methods of propagation, and complete directions for their successful culture in the garden, dwelling and greenhouse. By C. L. Allen. New York: Orange Judd Company. 1893. 12mo. Pp. 320, illustrated, cloth. Price $2.

Hardly any other class of plants occupies so important a place in the field of floriculture as do the various kinds of flowering bulbs and is at the same time so little understood. The present work describes the varieties to plant, the soil, losses, etc. The author of this book has for many years made bulb growing a specialty, so that the statements in regard to bulb growing may be relied upon.

GUIA AUTENTICA DE LA EXPOSICION UNIVERSAL COLOMBIANA DE CHICAGO, 1893. Traducida por Joaquin A. Vargas. Chicago: Poole Bros. 1893. 18mo. Pp. 88, cuts, maps.

A small guide book not only to the Fair itself, but also to Chicago. A large amount of information useful to foreigners is given. No Spanish visitor to the Fair should be without this little work.

A LABORATORY MANUAL. By W. R. Orndorff, Ph.D. Boston: D. C. Heath & Co. 1893. 16mo, boards. Price 40 cents.

This interesting little work is intended as an adjunct to Ira Remsen's "Introduction to the Study of the Compounds of Carbon." The metric system is used throughout. The right hand pages are reserved for students' personal notes. The questions after each experiment are excellent. Among the experiments are the preparation of acetylene, benzene, aniline, starch, phenol, cellulose, salicylic acid, Fehling's solution, oxalic acid, flashing point of kerosene, saponification, acetic acid, alizarin, etc.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5404) Constant Reader writes: Will you kindly inform me through your valuable paper the component parts of concrete? I saw in your paper a long time ago (I did not need to use it then) an article respecting a buildi g, I think, in England, where they had used saccharine in some form, which had a hardening effect upon it, which is very important. If so, please state how much may be used in a given quantity. Please give all the information you can, as I want to build a large building with that material, if I can be persuaded it will be sufficiently strong. A. The proportions for concrete vary somewhat, depending upon the nature of the work and required strength. With the best American hydraulic cements, 1 part by measure to 2 parts sand, with an equal bulk of broken stone, makes a good strong concrete for pressure in the foundations of buildings and for walls. This may be varied to 1 part cement, 3 parts sand, 4 parts broken stone, for ordinary subwork. The use of sugar in mortar has been proved highly beneficial to its strength and hardness, and also enables brick laying to be carried on in frosty weather, as such mortar does not freeze at several degrees below the freezing point. The proportion of 2 pounds of common brown sugar to 1 bushel of lime and 2 bushels of sand makes a mortar that sets as hard as cement and much quicker than ordinary mortar. As the sugar is supposed to be a solvent of lime, it should be added to mortar in a thin sirup, the previous mixed mortar being as thick as it is possible to work it. The affinity of the sugar for the lime seems to partially dehydrate it and set free some water that thins the mortar. One pound of sugar to 16 gallons of water with the necessary lime makes a very hard and durable whitewash.

(5405) F. I. says: I noticed on an almanac that the sun's declination reaches 23° 27′ in June and December. Is this correct? If not, please give it correct. At what angle is the moon's path inclined to the earth's equator? What is the distance from earth to moon at apogee and perigee? What is the distance from earth to sun at aphelion and perihelion? A. 23° 27′ 6″ is the declination for this year. The moon's orbit is inclined 5° 8″ from the ecliptic, which gives the moon a variable inciination to the equator of 28° 35′ to 18° 19′ during the course of the regression of its nodes. Its mean distance is 238,840 miles. Its distance at apogee is 252,975 miles and at perigee 221,614 miles. The distance of the sun from the earth at aphelion and perihelion is about 3,000,000 miles over and under the mean distance, which is assumed at 92,897,000 miles.

(5406) G. F. W., New Jersey, asks whether a person can get a stationary engineer's license that lives in New Jersey, and has a position in New Jersey, as I have had the offer of a position as engineer, but I will require a license to secure same. Also inform me what part of New York City I can obtain them. A. Engineer's licenses are given by authorities acting under local laws for use in the district in which they are to be used. You should apply to inspectors in your State, if there are laws requiring license. The license department for engineers for New York City does not issue licenses or certificates to any engineer until he has secured a position in the city. The license department is at police headquarters.

(5407) E. J. P. says: Around the circumference of a circle whose radius is 200 feet, and making four revolutions per minute, a bird is flying. In the center of the circle, and moving his gun with the bird, stands a rifleman. If we suppose the bullet and bird to be each a mathematical point only, and the bullet to encounter no resistance from the atmosphere, where must he aim in order to hit the bird, no allowance being made for gravitation? A. The bird by computation will be flying 83·4 feet per second faster than the muzzle of the gun in the circuit, presuming the bullet to fly at the rate of 1,500 feet per second; $\frac{83{\cdot}4}{1500}$ then is 0·062 of a foot, or ¾ of an inch, that the bullet would strike behind the point aimed at.

(5408) R. R. J. asks: Please answer through your paper the following: How long can a storage battery stand in the acid without injury from sulphate, discharged? What is the remedy for a sulphated battery? Can it be fully restored? A. Sulphating, if bad, is cured by long overcharging with current about 30 p. c. below the maximum. Not the smallest speck of sulphate must be allowed to remain on the plates. Too great a charging current will cause sulphated plates to buckle. To prevent sulphating give a good charge once a month. The time required for bad sulphating cannot be stated. It varies under different circumstances.

(5409) S. G. S. writes: In your answer to J. W. S. (5318) I fully agree with you about putting the pump chamber in the water when it can be done. I don't fully understand what you mean by saying the only drawback in putting the cylinder 30 feet out of the water is that it is constantly liberating air from the water. A. All water in the natural state contains air in solution, which is entirely liberated under a vacuum; 30 feet above the water is very near the vacuum line. Under its action most of the air is disengaged by expansion and interferes with the economical action of the pump.

(5410) J. B. R. asks: What would be the difference in price between coal at $2.64 per ton and petroleum at about 3 cents per gallon, for an equal number of horse power? Also the name and address of crude petroleum burners on the market. A. Coal at the price named is $\frac{118}{1000}$ of a cent per pound, and if of good quality is equal to 14,000 heat units per pound. Petroleum at price named is four-tenths of a cent per pound and equal to 20,000 heat units per pound. The proportion figures that coal at the price stated is two and three-eighths times cheaper than petroleum for fuel. W. J. Gordon, 235 Broad Street, Philadelphia; Meyers & Osborn, Cleveland, Ohio; Schutte & Goehring, Philadelphia; Aerated Fuel Co., Springfield, Mass., are manufacturers of petroleum burners for boilers. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 623, 624, 673, for illustrated descriptions of petroleum burners.

(5411) C. S. W. asks for a receipt for bleaching or removing the oil from calfskins. A. The removal of oil from oil-dressed leather is practiced as specialties by concerns in the Eastern States, by the naphtha process, by immersing the leather in naphtha in closed vessels for a suitable time, to extract the whole or a part of the oil as desired, when it is subjected to pressure for removing the naphtha and then dried. Bleaching is further promoted by a bath of oxalic acid and acetate of lead dissolved in water. The details of these processes are kept as much as possible a trade secret. We have no literature on this subject.

(5412) W. C. C. writes: When an ordinary charged storage battery is left untouched for about 200 days, no longer can any current be gotten from it. Is this due simply to the oxidation of the spongy lead plate, or does the peroxide on the other plate also undergo change? A. A spontaneous discharge is due to leakage. The material of the cell or surface moisture on the cell may act as a conductor and passes a slight current, which slowly exhausts the charge. Sulphating also takes place. A wet surface under the cells also tends to discharge them by acting as a conductor.

(5413) G. B. C. asks: What is the best thing to clean nickel plating, bicycles for instance, and to prevent their rusting? A. Polish the nickel plating with a paste made of vaseline and rouge and wipe the polished surface with a cloth moistened with vaseline.

(5414) C. H. McD. asks what to mix red lead with in order to make it stick to storage battery plate instead of using flannel. A. An excellent plan is to mix the red lead with 10 per cent sulphuric acid, to apply it as a paste to the roughened plate and holding it in position with parchment paper or other material to form the plate. After forming, remove the paper. There is no available cement for the purpose.

(5415) M. D. asks for proportions of bicarbonate of sodium, tartaric acid and flour to make baking powder. A. Mix two parts tartaric acid, three parts sodium bicarbonate, and three parts powdered starch, all parts by weight.

(5416) J. W. L. says: Can you inform me how pearl is colored to become smoked pearl? A. The smoked pearl is dyed after finishing, with aniline and other colors, and then polished.

(5417) R. B. S. says: I have a circular glass plate 18 inches in diameter and I wish to drill a ½ inch hole through the center. A. The hole can be cut with emery and water fed into a copper or brass tube revolved in a guide of wood or metal fastened to the glass with wax. The tube may be revolved between the hands or by a bow string; in the latter case a center should be fixed to the top of the tube by which to hold it in position when the bow string is turning it.

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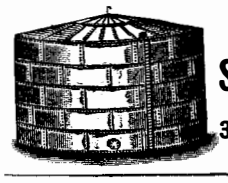

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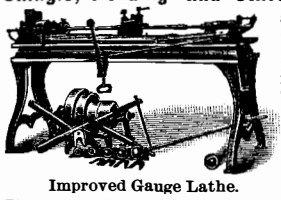

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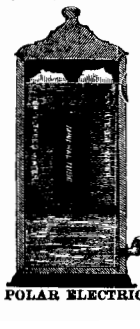

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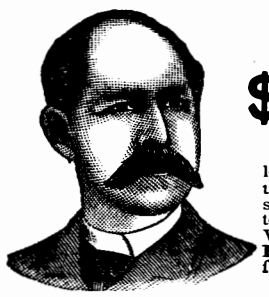

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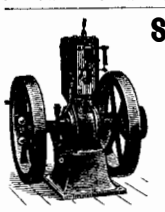

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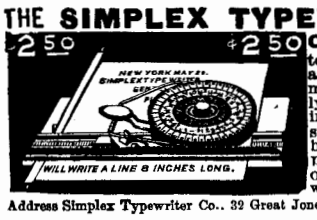

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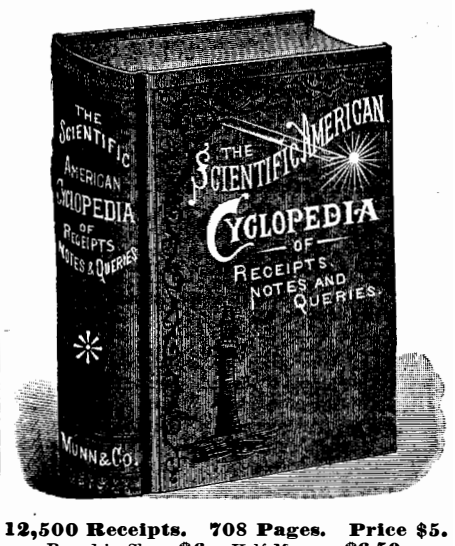

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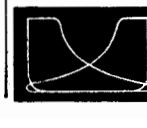

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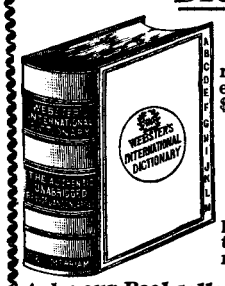

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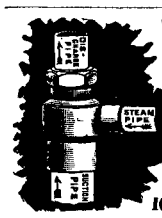

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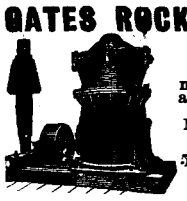

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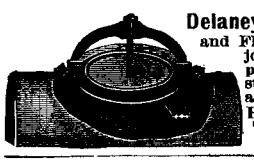

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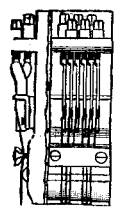

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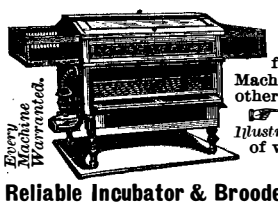

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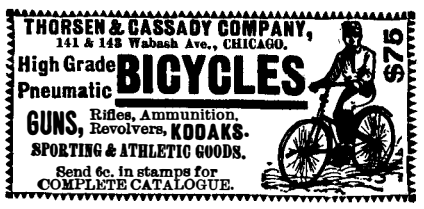
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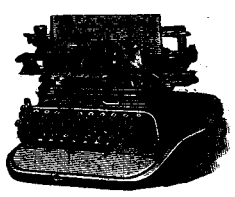

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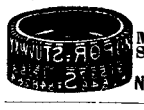

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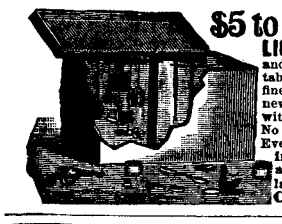

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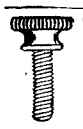

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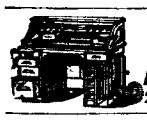

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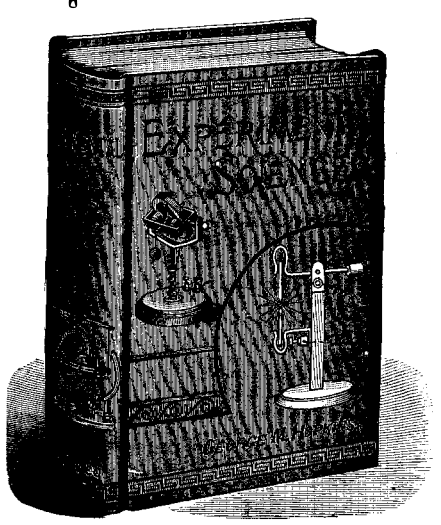

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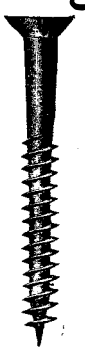

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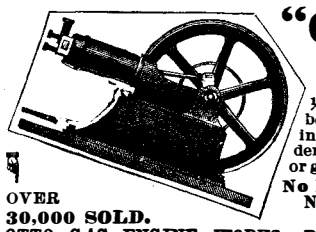

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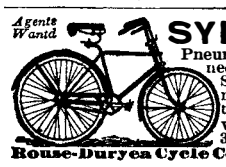

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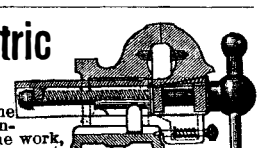

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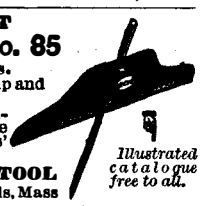

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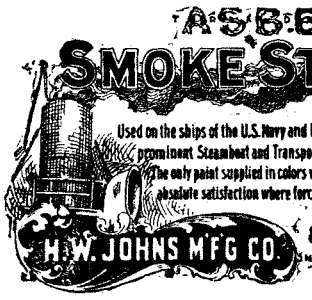

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